

Custer

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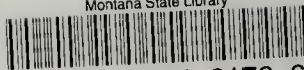
COMPREHENSIVE
AREA-WIDE
WATER and SEWER
PLAN
1970

STATE OF MONTANA-VOLUME 17

CUSTER, POWDER RIVER, FALLON & CARTER COUNTIES



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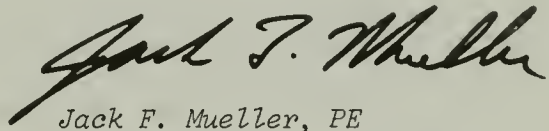
Gentlemen:

In accordance with our agreement for water and sewer planning for forty nine of the fifty six counties in Montana, we hereby submit this Comprehensive Area-Wide Water and Sewer Plan.

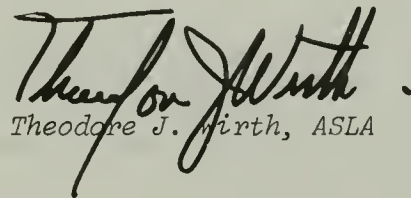
This report is based on engineering and planning studies made throughout the county areas. The population characteristics and trends, the economics, and the natural resources of the counties were carefully analyzed. Based on information gathered from the study and on examination of existing water and sewer facilities, recommendations for new or improved water and sewer facilities were made where applicable.

We wish to express our appreciation for the cooperation we received from the federal and state agencies we have worked with and from the administrative agencies, from the community and civic leaders, and from the residents of the counties involved.

Respectfully submitted,

A handwritten signature in black ink, reading "Jack F. Mueller".

Jack F. Mueller, PE

A handwritten signature in black ink, reading "Theodore J. Wirth".

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INTRODUCTION

The State of Montana is basically rural in nature with the vast majority of its people still living in small rural communities and there is every indication this situation will prevail for many years. It is important, therefore, to provide adequate and suitable water and sewer facilities for this rural population. It is just as important as for the larger urban areas, but this need of rural communities is often overlooked in our rapidly urbanizing society.

This Comprehensive Water and Sewer Study analyzes the present state of water supply and sewage disposal and is based on projected changes in population, economy, and land use. It projects improvements and additions required to meet needs during the next twenty years. Although the report is technical in nature, every effort has been taken to make it understandable to any interested person while retaining those details required for persons responsible for engineering these facilities. Adequate water and sewer facilities can be provided only with the active support of an informed and concerned citizenry.

While the general purpose of this study is to provide information necessary for coordinated planning of water and sewer facilities on a county wide basis, the specific aims of the study are to:

1. Develop an awareness on the part of the people of rural areas as to their water and sewer problems and needs.
2. Provide the information necessary for a concerned citizenry to be properly informed on water and sewer problems and needs.
3. Develop on the part of the people affected a desire to solve present or projected problems connected with water and waste disposal.
4. Suggest best and alternative sources of water and methods of waste disposal.
5. Prevent unnecessary duplication and underdesign or overdesign of water and sewer facilities.
6. Coordinate use of common facilities such as water supplies and waste treatment plants.

This plan encompasses all rural communities within the county containing five or more dwelling units but having a population of less than 5,500. The requirements of the Farmers Home Administration, which funded the project, and the Montana Department of Planning and Economic Development concerning water and sewer plans are satisfied by this study.

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CUSTER COUNTY

MONTANA

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CUSTER COUNTY
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CONCLUSIONS, RECOMMENDATIONS, AND PRIORITIES

Conclusions

The total population of Custer County is expected to decline slightly during the planning period. The decrease in population is expected to take place throughout the county, and thus it is expected that rural community populations will also decline.

The only existing central water and sewer facilities in Custer County are those which serve the city of Miles City. The communities studied in this report, Ismay and Kinsey, are presently served by privately owned individual water supply and sewage disposal facilities such as wells and septic tanks. It is expected that these facilities will continue to serve these communities adequately throughout the planning period; however, it has been noted that installation of central facilities in Ismay may help to avert the steady decline in population predicted for this community.

Recommendations

This plan shows the various types of improvements which the communities should be considering during the planning period. Elaborate systems are not proposed but rather those facilities necessary to provide safe and adequate community systems. It is recommended that this general plan be adopted by the governing agencies of each community. A detailed approach, which must be undertaken to insure completion of the improvements in each community, cannot be covered in a report of this type. Community leaders, however, do have several courses of action which may be taken.

Most small communities do not have the means to plan and finance complete water and sewer systems. Therefore, to enable communities to acquire such facilities, five departments of the Federal Government have legislation authorizing loans or grants for construction of public works. These agencies are:

Farmers Home Administration
United States Department of Agriculture
P. O. Box 850
Bozeman, Montana 59715

Federal Water Quality Administration
United States Department of the Interior
% Montana State Department of Health
Helena, Montana 59601

Public Health Service
United States Department of Health, Education, and Welfare
Division of Indian Health
Billings, Montana 59101

Administration for Metropolitan Development
United States Department of Housing and Urban Development
Assistant Regional Administrator
Denver Regional Office
1050 South Broadway
Denver, Colorado 80209

Economic Development Administration
United States Department of Commerce
Montana Field Coordinator
207 Medical Arts Building
Butte, Montana 59701

The legislation is constantly changing; therefore, community leaders should investigate the various alternatives and determine which program and course of action would be most beneficial to them.

Priorities

That a particular system requires immediate improvements and another system will be satisfactory for a definite period is difficult to establish. Several indicators for establishing priorities are available, however. The general health of the people is the prime consideration, and this can only be insured when safe water supplies are provided. Water supply in adequate quantities is another important factor. Waste water must be treated and disposed of by safe methods to minimize the problems of pollution and to protect public health. The total number of persons benefited by any improvement must also be considered.

In Custer County only the community of Ismay shows a possible need for improvements. Thus, a priority listing of projects is not necessary for Custer County; however, the proposed facilities for Ismay are listed as follows:

1. Ismay Sewer System. Local demand has not developed to the point where the construction of this facility is required; however, the present size of the community and potential health hazards are reasons to warrant planning and construction of this project.

2. Ismay Water System. This proposed improvement is not immediately needed; however, following the construction of a central

sewer system or the advent of well contamination problems planning for construction of this project should begin.

THE LAND

General Characteristics

Custer County is located in the southeastern portion of the state. It is bordered by Prairie County on the north, Rosebud County on the west, Powder River County on the south, and by Fallon and Carter Counties on the east. The county covers a total of 3,775 square miles of which ten square miles are water surface area.

The topography on Map 1 indicates that the land is generally of the rolling plains type in the eastern and western portion of the county. The middle part is comprised of break land interspersed with small coulees. Elevations vary from around two thousand feet in the Yellowstone Valley near Shirley to about four thousand feet on the southern boundaries.

An adequate highway system covers the county with Miles City serving as the main hub. U. S. Highway 10, which becomes Interstate 94 for much of the distance, traverses the county in a southwest to north-east direction. It connects with Forsyth in the west and to Terry in the east. U. S. Highway 312 enters from Powder River County to the south and then continues westerly out of Miles City on the same route as U. S. 10. U. S. Highway 12 enters from Fallon County to the east and joins Interstate 94 at Miles City. Miles City is connected to Jordan by State Highway 22. Several gravelled and unpaved roads tie the remainder of the county into the state and federal highway system.

There is one paved, 6,300 foot, public, minimum facility airport in the county located in Miles City. Daily air service and connections to nation wide airlines are available at nearby Glendive.

The main line of the Chicago, Milwaukee, St. Paul, and Pacific Railroad provides freight service to the county, and the southern main line of the Burlington-Northern Railroad provides both freight and passenger service. The North Coast Limited and the Mainstreeter passenger trains travel the route four times daily; the number of daily freight trains varies with the need in the area. The two rail lines parallel each other and extend northeast-southwest across the northwestern corner of the county.

Electrical power is provided by two companies. Montana-Dakota

Utilities has a main transmission line running from Glendive, passing through Miles City, and terminating at Forsyth. The largest portion of the county is serviced by the Tongue River Electric Cooperative of Ashland. The firm is supplied power by the United States Bureau of Reclamation and by the Montana Power Company.

Since major power producing centers and relay stations are usually located at widely separated points and provide power service to large areas, Map 2 shows the major power grid system for the entire State of Montana. Major gas transmission lines are also shown.

Telephone service is provided by three companies in Custer County.

Mountain States Telephone Company serves a large area surrounding Miles City and the Mid-Rivers Telephone Cooperative extends service to part of the northern county area. The remainder has service from the Range Telephone Cooperative centered in Forsyth.

Land Ownership and Use

Chart 1 indicates the presence of three ownership categories in the county. Private ownership is the largest and accounts for three out of every four acres of land. Land under federal ownership represents seventeen percent of the county while the State of Montana claims the remaining six percent.

The land use pattern generally reflects the physical characteristics of the county. Ninety five percent of all lands are used for agriculture, thus reflecting the suitability of the county for cattle grazing and crop production. Both forests and commercial uses account for one percent each of the total land while the remaining three percent represent other uses such as town sites, transportation routes, and other uses not included in the other three categories.

Natural Resources

Sand and gravel were the most important natural resources listed for Custer County in 1967. Other resources exist in the area, but were not produced in that year on a scale economically important to the county.

The demand for sand, gravel, and stone stems from highway and railroad construction and maintenance needs, and the amount of the resource produced depends on the extent of those activities in the area. Other counties normally produce their own sand, gravel, and stone thus limiting the export demand.

CHART 1

Land Ownership
Custer County

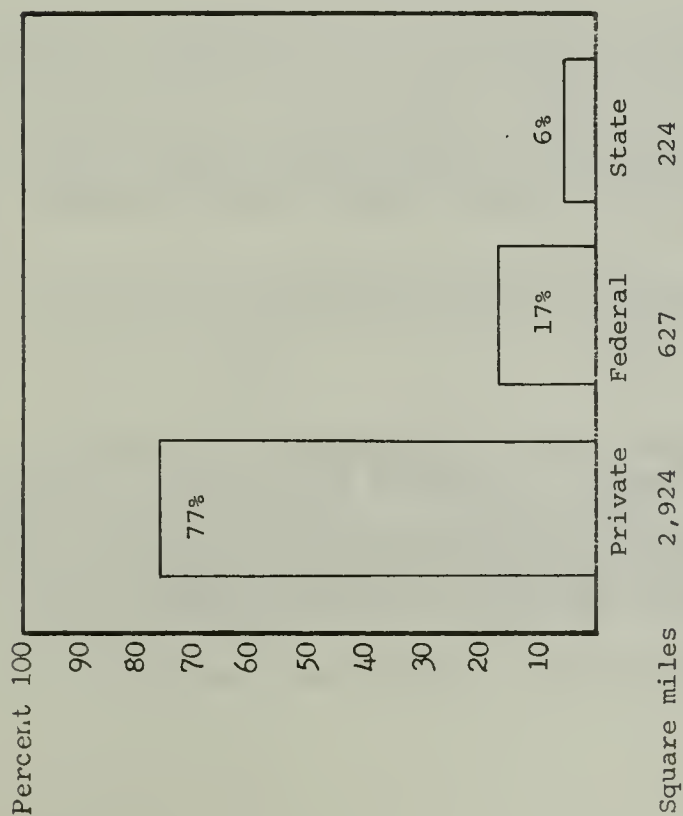
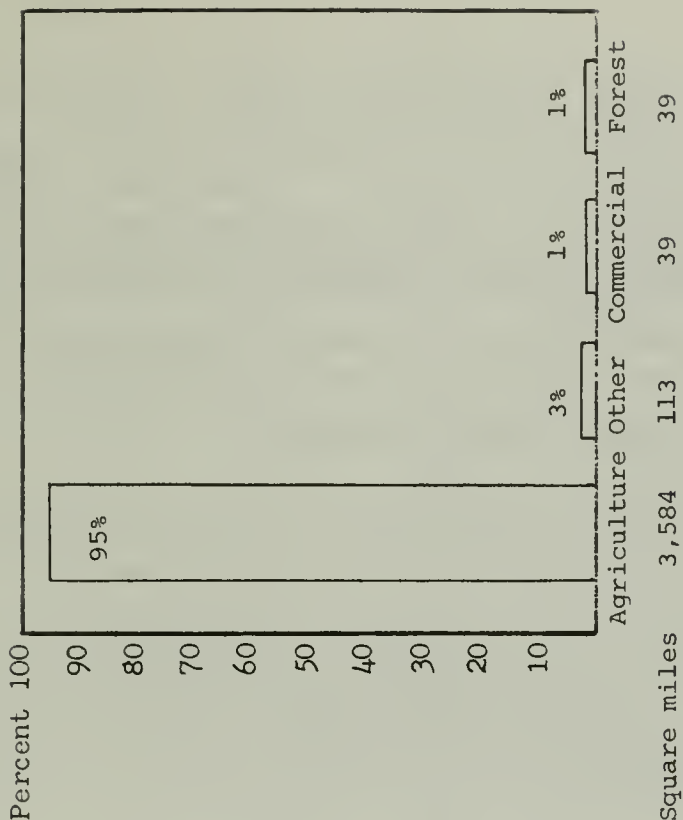


CHART 2

Land Use
Custer County



Sources: 1. The Montana Almanac, 1959-60
2. U.S. Census of Agriculture, 1964

Coal bearing lands cover almost the total county. The United States Department of the Interior estimates that 3,635 square miles of the 3,775 square miles which comprise the county are in this category. Two percent of all the coal in Montana is located here. The total reserves include 2,678 million short tons of sub-bituminous and 2,198 million short tons of lignite coals. At present, however, mining is not economically feasible because of high extraction costs.

At present, petroleum production has not been as successful as in neighboring counties. In 1968 fifty one wells were drilled, but all were non producers. Liscom Creek in the southwest corner of the county is a non producing natural gas field.

Another important natural resource in any area is the recreational opportunities available. Custer County lies in the heart of the old Montana cow country and vestiges of the illustrious past can still be seen in the Range Rider's Museum in Miles City and out along the rural backroads of the county. The area offers fine big game hunting for whitetail and mule deer and antelope. Upland game birds are plentiful and the numerous rivers and streams of the area abound with various game fish. The recreation potential of the area is enhanced by the easy accessibility available through Interstate Highway 94 which traverses the county.

Soils

There are two general types of soils in the county. The first is the range grass and field crop supporting type. The agricultural pattern, covered later in this report, indicates that almost two farms in three were livestock producers, thus substantiating the range grass growing capacities of the soil. The second general category of soil is the forest supporting type, a smaller category generally found at higher elevations.

Soils data is covered in more detail later in this report.

Water

There are five drainage areas of significance in the county. The largest is the Yellowstone River which flows across the northern part of the area. The drainage area of the Yellowstone and its river valley has determined the development pattern for Custer County. The Tongue River, Pumpkin Creek, Mizpah River, and Powder River also flow in the county and are tributaries of the Yellowstone River.

Both surface and ground-water resources are covered later in this report.

THE PEOPLE

Population

For analytical and projective purposes, it is necessary to study the population history of Custer County to find out what has happened and what is going to happen. Chart 3 graphically shows the growth of the county as compared with that for Montana and indicates the future growth for both.

With the exception of 1950 and 1960, the number of persons in the county has declined since 1920. Since 1960 the population dropped by nine percent to a figure just less than that recorded in 1920. The projected 1990 population shows a total figure of one thousand less than for 1920.

Custer County was classified as a semi rural area in 1960 containing at least one incorporated town of 2,500 or more persons but being included neither in nor near a Standard Metropolitan Statistical area. Table 1 indicates the population change for the urban, farm, and rural non farm areas of the county. From 1950 to 1960 the rural population grew at a rate two and one half times faster than its urban counterpart. All rural growth occurred within the non farm areas while the farm areas declined. During the last ten years the rural population declined twice as fast as the urban population. Over the twenty year reporting period, because of Miles City, the urban population represented three fourths of all persons in the county. The farm population represented a lower percent while the rural non farm group increased from ten to fourteen percent.

From 1950 to 1960 the population of the county decreased by 566 persons. Chart 4 indicates that the decline is a result of 2,265 births over deaths and a net migration loss of 1,699 persons.

The change in sex composition from 1950 to 1960 is shown in Chart 5. As shown, the ratio for both sexes is close with a slight preponderance of males over females. No change is anticipated throughout the twenty year planning period.

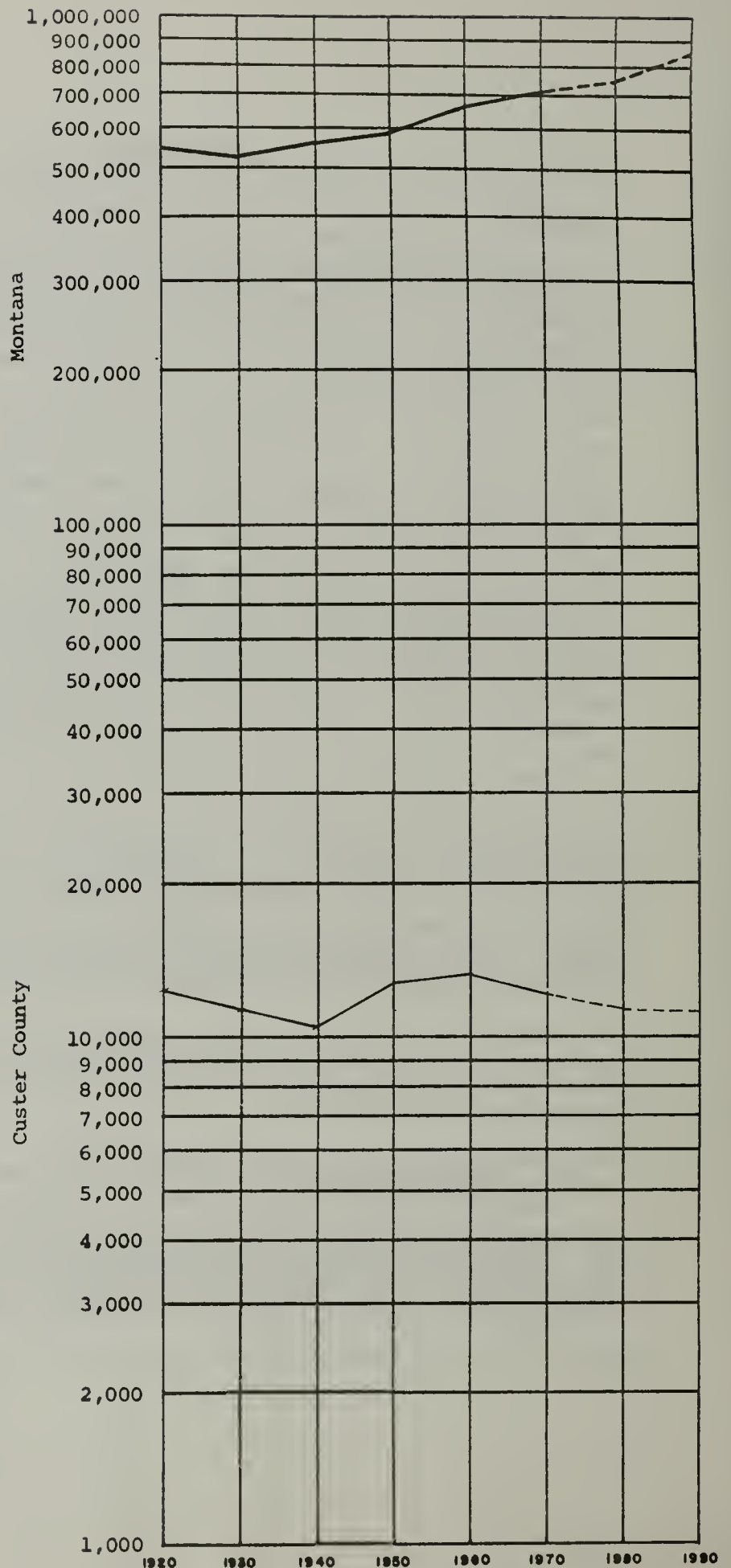
The age distributions by sex for 1950 and 1960 are shown in Table 2. Gains occurred within most age groups.

The communities of Ismay and Kinsey were studied in Custer County. The communities of Volberg and Locate were also studied but were not included in this report because of insufficient population and development.

CHART 3

COMPARATIVE
POPULATION
TRENDS

Custer County
and Montana



Sources:

1. U.S. Census of Population
2. Intermountain Planners, Inc.

TABLE 1
Urban-Rural Population Changes for Custer County
1950-1970

	<u>1950</u>	<u>1960</u>	<u>Changes</u> <u>Number</u>	<u>1950-1960</u> <u>Percent</u>
Total	12,661	13,227	+ 566	+ 4.5
Urban				
(Inc. Towns)	9,425	9,724	+ 299	+ 3.2
Rural	3,236	3,503	+ 267	+ 8.3
Farm	1,924	1,747	- 177	- 9.2
Non Farm	1,312	1,756	+ 444	+33.8
	<u>1960</u>	<u>1970</u>	<u>Changes</u> <u>Number</u>	<u>1960-1970</u> <u>Percent</u>
Total	13,227	12,000	-1,227	- 9.3
Urban				
(Inc. Towns)	9,724	9,000	- 724	- 7.4
Rural	3,503	3,000	- 503	-14.6
Farm	1,747	1,300	- 447	-25.6
Non Farm	1,756	1,700	- 56	- 3.2

Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

Because of the time that has elapsed since the 1960 Census, current population estimates had to be derived from several sources in the field. Surveys and interviews were conducted to determine what now exists and what is expected in the future.

Table 3 indicates the past population experience and the future projections for Ismay and Kinsey. As indicated, the population of each is expected to decline throughout the twenty year planning period. The number of persons in Ismay will drop from fifty to twenty and in Kinsey from ten to seven.

The population figures reflect only those factors and trends for which information is available. New technological advances, new industries,

TABLE 2

Age & Sex Composition of Custer County

<u>Age Group</u>	<u>1950</u>		<u>1960</u>	
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
Under 5	715	786	783	796
5-14	1,088	951	1,337	1,366
15-19	495	458	596	432
20-24	459	451	382	369
25-34	965	971	777	770
35-44	834	762	835	805
45-54	639	618	662	660
55-64	718	588	545	554
65-74	470	353	515	467
75 +	179	161	317	259
Total	6,562	6,099	6,749	6,478

Source: U. S. Census of Population, 1950-1960

TABLE 3

Population Forecast for Towns and Communities

	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1990</u>
Ismay	182	59	50	45	40	20
Kinsey	4	25	10	10	9	7

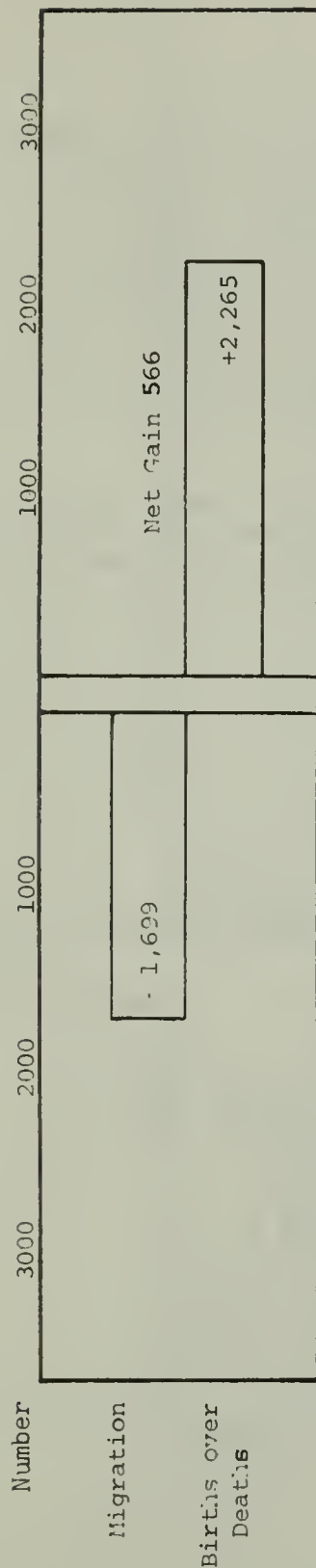
Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

or other unforeseen events may alter these projections. If such an event occurs, the areas affected should be studied in light of the new conditions.

CHART 4

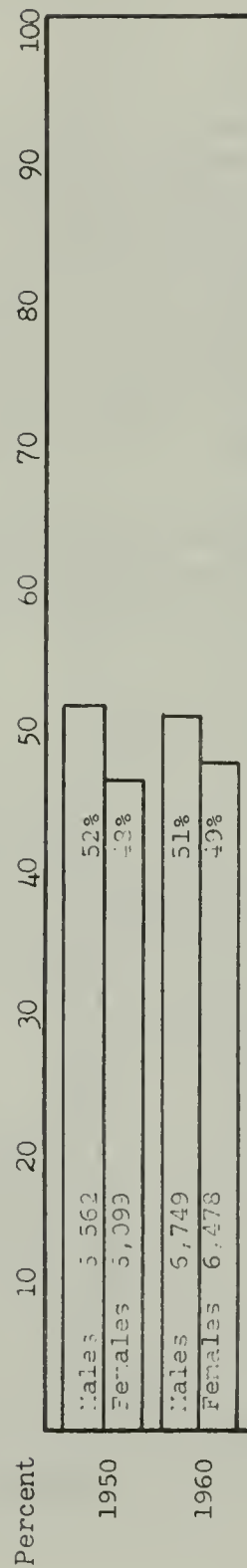
Population Change
Custer County 1950 - 1960



Source: Net Migration of Population, 1950-1960 by Age, Sex, and Color,
U. S. Department of Agriculture

CHART 5

Population by Sex
Custer County 1950 - 1960



Source: U. S. Census of Population, 1950-1960

Housing

There were 4,665 housing units in Custer County in 1960. Two thirds of all housing were located in Miles City and were classified as urban. Chart 6 indicates that thirteen percent were located in rural non farm areas with the remainder representing farms. The median housing unit size was 4.20 rooms per unit, and the median household size per occupied unit was 3.09 persons. Just over half of all housing units were owner occupied and one third were used for rental purposes. Chart 7 indicates that eleven percent were vacant. The 1960 condition of housing is shown in Chart 8. One percent of the homes were in need of replacement and thirteen percent needed repair. The remainder were classified as sound.

Chart 9 reflects the 1960 status of housing units in terms of source of water, water supply, and method of sewage disposal. For geographical reference, the data shows the status for Custer County as a whole and for the urban, non farm, and the farm areas.

HOUSING Custer County 1960

Chart 6
Housing Classification

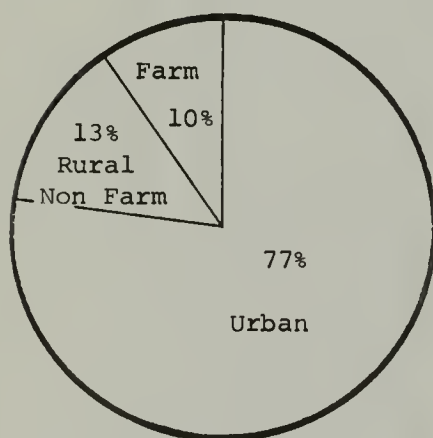


Chart 7
Housing Tenure

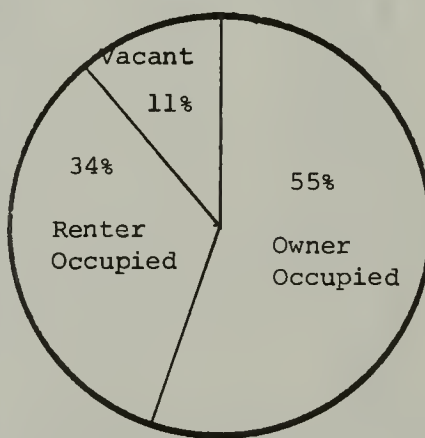
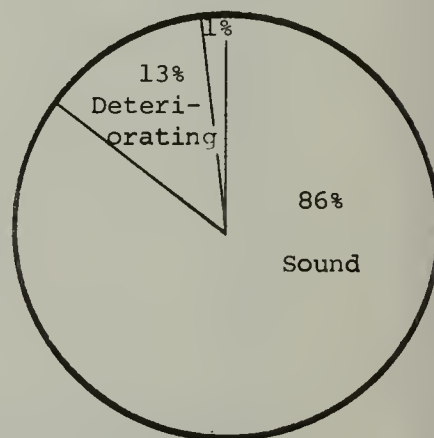


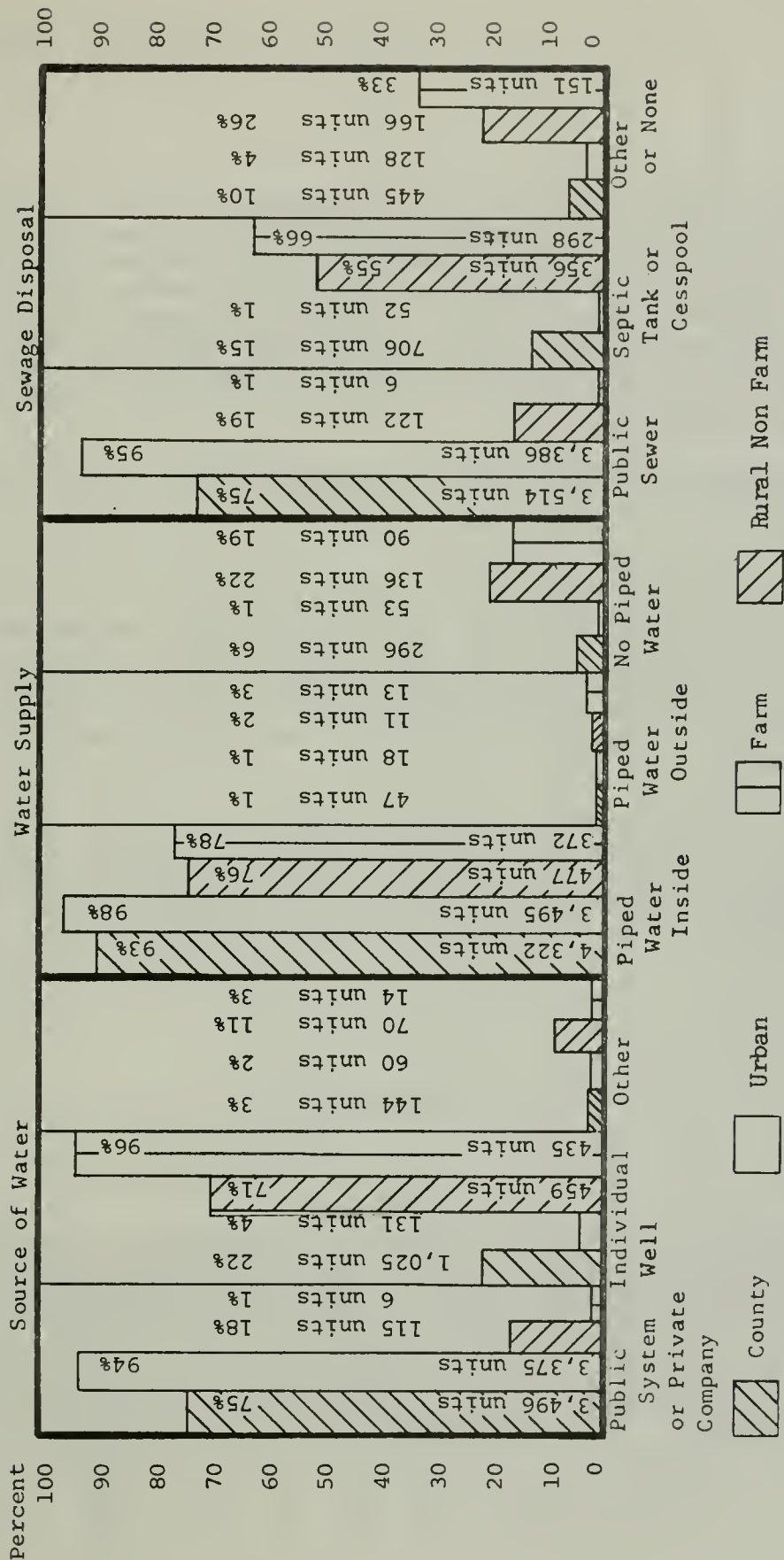
Chart 8
Housing Condition
Dilapidated



Source: U. S. Census of Housing, 1960

CHART 9

Sewer and Water
Custer County 1960



Source: U. S. Census of Housing, 1960

Three fourths of all homes in the county were provided water by a public system or by a private company in 1960. Those served included most of the homes in Miles City and very few elsewhere in the county. One fifth of the rural non farm homes and one percent of the farms used the same source of water. The remaining homes generally relied on individual wells for water. Almost three fourths of the rural non farm homes and ninety six percent of the farms used that source for water. Only three percent of the homes received water from still another source.

Six percent of all homes did not have piped water in 1960. The figure included about one fifth each of the rural non farm homes and the farms.

Because of the inclusion of Miles City sewer data in the county figures, three fourths of all homes in the county handled sewage disposal by means of a public sewer system method. Generally, the homes out of Miles City used either septic tanks or cesspools. Only ten percent of the homes, which included one fourth of the rural non farm homes and one third of the farms, used another method for waste disposal.

The 1960 housing data indicates an inadequacy of water and sewer systems. Only Miles City appears to be properly served while the remainder of homes throughout the county lacks such facilities. The needs of the rural non farm homes, which represent the small urban developments in the county, need to be considered.

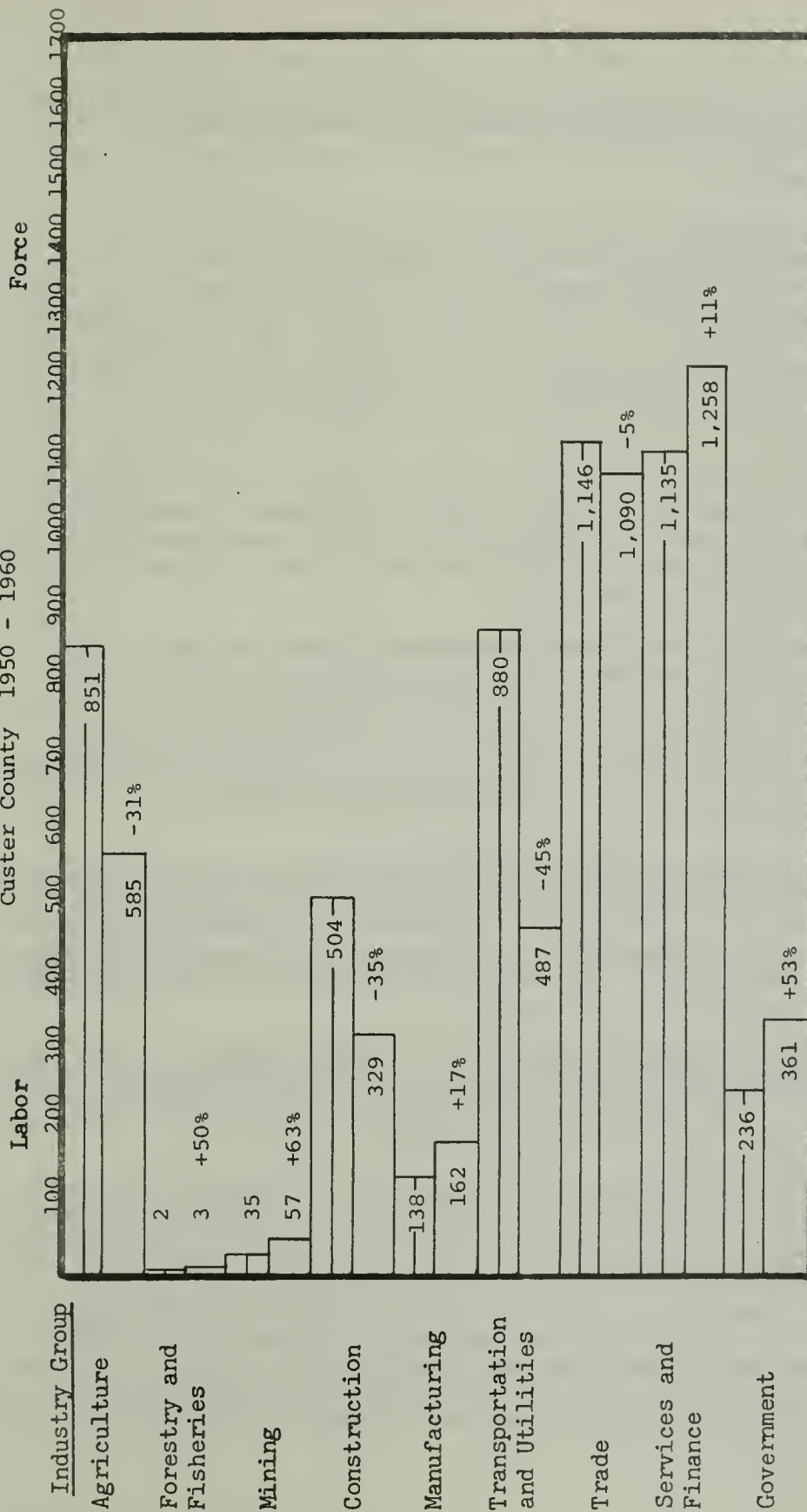
THE ECONOMY

Labor

People have a direct relationship on the economy of an area because of their roles as both producers and consumers of goods and services. The following economic analysis of Custer County is concerned primarily with the total economic spectrum and how it may affect the future of the area. Changing economic conditions can have either a good or a bad effect in terms of population growth, ability to provide for public improvements, or in determining the general overall living environment.

CHART 10

Employment Change by Major Industry Group
Custer County 1950 - 1960



1950 Total Employment 5,008*

1960 Total Employment 4,502*

*Includes Some Industries Not Reported

Source: U. S. Census of Population, 1950-1960

Employment in the county decreased by ten percent between 1950 and 1960 while the population increased by almost five percent. The decline in labor is contrasted with a six percent gain for Montana in the same period.

Employment changes by major industry groups are shown in Chart 10. During the ten year period the county was one of three in the southeastern portion of the state having an increased population. Employment dropped a tenth while unemployment rose. The number of females working increased a tenth while their share of jobs increased by a third. Transportation and utilities accounted for two fifths of all job declines while agriculture and construction were responsible for an additional thirty percent and twenty percent respectively.

The trade and the services and finance groups were the largest employment categories in 1960. Their predominance is explainable in that Miles City serves as a trade center for a seven county area. Complete shopping facilities are available there in addition to an adequate selection of services.

An analysis of the employment characteristics of the two groups further indicates the regional role that Miles City plays. Almost one worker in five in the trade group was engaged in wholesale trade while almost half were represented by the retail sales industry. Grocery store employment accounted for an additional eleven percent, and one fourth of the total employment was represented by restaurant and bar activities.

Hospital employment accounted for one fourth of all employment in the services and finance group primarily because of the presence of the federal hospital in Miles City. Educational employment represented an additional thirteen percent and personal services another eighteen percent. Employment in the professional services segment was responsible for one in ten in the group.

Agricultural employment declined by one third between 1950 and 1960 and resulted in the group representing the third largest share of the labor force. The employment rate for this group in the county is generally lower than that for the state.

Percentages for employment by industry group in Table 4 provide an insight into local employment characteristics. The table shows the relative weight of each industry group and offers a comparison with that existing in 1960 for the State of Montana and the United States. The services and finance industry group accounted for the largest percent of labor in 1960. The employment rate was eleven percent higher than that of the state and almost double that for the nation.

The trade industry group represented the second largest segment of the

TABLE 4

Percent of Total Employment by Industry Groups

Custer County, Montana and United States

1960

	<u>Custer County</u>	<u>Montana</u>	<u>United States</u>
Agriculture	14	17	11
Forestry and			
Fisheries	1	1	1
Mining	1	3	1
Construction	7	7	5
Manufacturing	4	10	27
Transportation			
and Utilities	11	9	7
Trade	25	21	19
Service and			
Finance	29	26	16
Government	8	6	13
Total	100	100	100

Source: U. S. Census of Population, 1960

labor force. The employment rate also exceeded that for Montana and the United States.

The remaining employment levels generally corresponded with that found in the state.

The Employment Security Commission of Montana publishes labor statistics on an annual basis. According to 1969 data, employment has declined further since 1960. The one exception occurred in the mining group, which increased by almost two thirds.

Continued growth for Miles City as a trade center will continue. The economy will also grow as a result of oil production in adjacent counties.

Agriculture

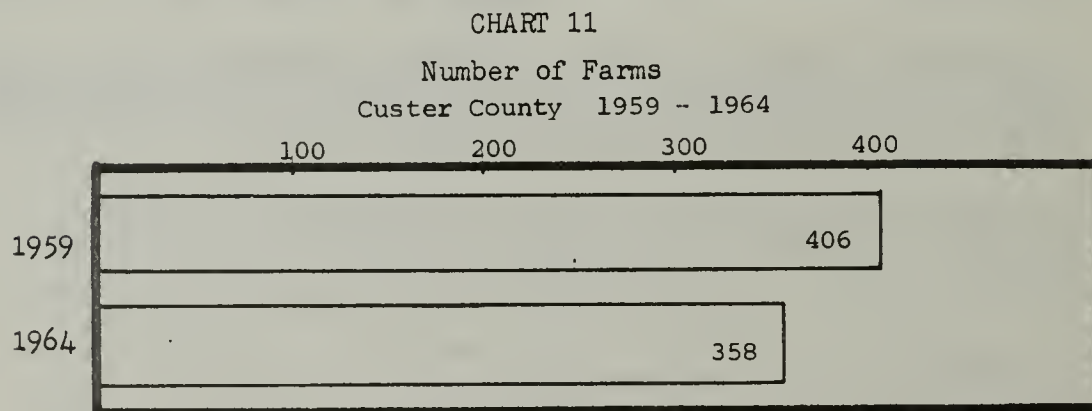
A farm is defined in the United States Census as a place having at least ten acres of land devoted to agriculture and selling at least

fifty dollars worth of agricultural products annually. According to Chart 11, there were 358 farms in Custer County in the above category in 1964, twelve percent fewer than there were in 1959.

The 1964 classification of farms by type was as follows:

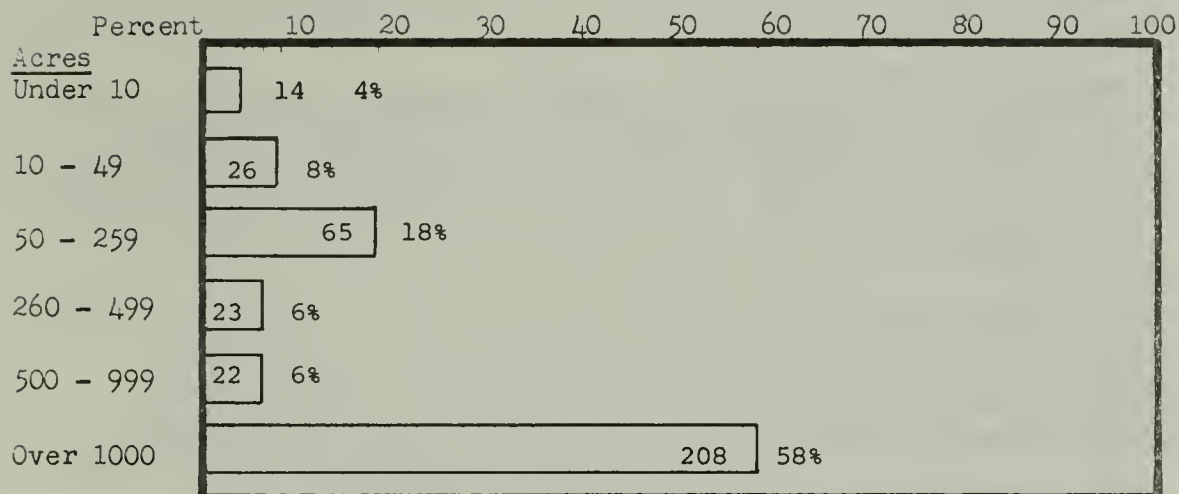
Field crop farms other than vegetables, nuts, and fruit	56
Cash grain	17
Other field crops	39
Poultry farms	2
Dairy farms	6
Livestock farms other than poultry and dairy	210
General farms	23
Miscellaneous and unclassified	61
	—
Total	358

Of the total number of farms, twenty seven were classified as part



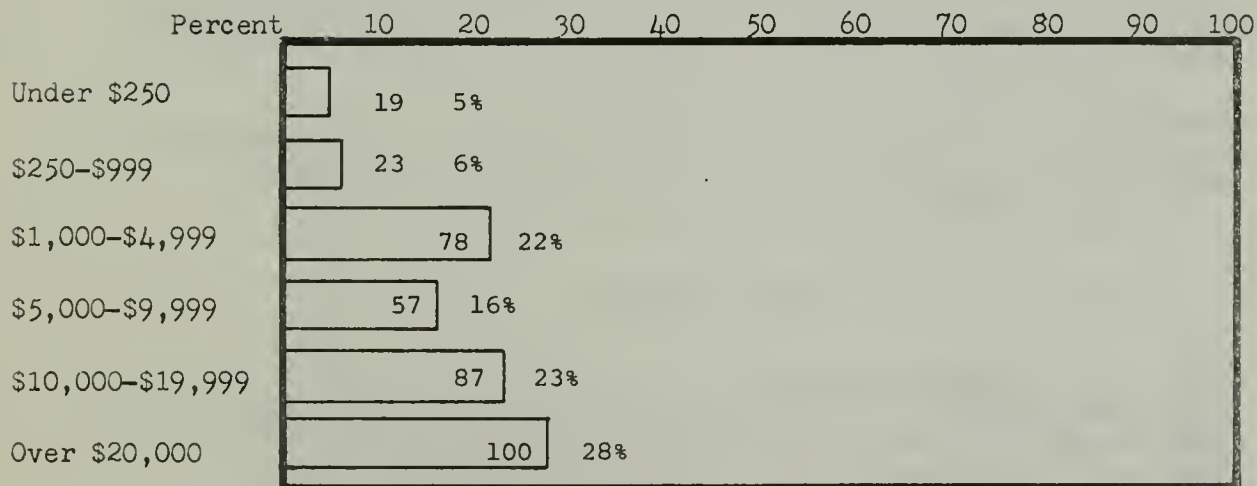
Source: U. S. Census of Agriculture, 1964

CHART 12
Farms by Size
Custer County 1964



Source: U. S. Census of Agriculture, 1964

CHART 13
Number of Farms by Value of Farm Products Sold
Custer County 1964



Source: U. S. Census of Agriculture, 1964

time, and twenty four were classified as being operated by semi retired persons.

Over half of all farms were primarily livestock producers, and only one farm in six raised cash crops. About one fourth of the farms were general or unclassified in nature. The average farm in 1964 was 6,892 acres in size. Chart 12 indicates that fifty eight percent of all farms exceeded one thousand acres, and one third were under five hundred acres.

The value of products sold by the number of farms is shown in Chart 13. According to the data, over half of all farms received in excess of \$10,000 for the sale of agricultural products, twenty eight percent reported sales totalling more than \$20,000, and one third of the farms had gross receipts under \$5,000 for products sold.

Cash receipts data from 1964 to 1967 are as follows:

<u>Year</u>	<u>Livestock</u>	<u>Crops</u>	<u>Total</u>
1964	\$5,277,400	\$1,909,500	\$7,186,900
1965	\$6,140,700	\$1,337,700	\$7,478,400
1966	\$7,930,900	\$1,725,300	\$9,656,200
1967	\$6,692,100	\$1,907,800	\$8,599,900

In 1964 the sale of livestock products accounted for about three fourths of all agricultural products sold. The ratio increased over the four year reporting period, indicating the importance of livestock in the local agricultural economy.

Farming will continue to function as in the past. Increased mechanization and consolidation will result in fewer but larger farms throughout the planning period.

THE GOVERNMENT

Before any meaningful consideration can be given to major capital improvement projects, it is necessary to study the governmental organizations in Custer County and to analyze their economic structure. At present there are two separate, local governmental units in the county involved within the scope of the water and sewer study. Included are the incorporated city of Ismay and the government of Custer County.

A Board of County Commissioners presided over by a chairman governs the county. The incorporated municipalities are governed by a mayor council form of government.

In financing capital improvement projects, the incorporated municipalities have power to bond and raise the necessary monies for funding projects. The unincorporated small towns do not have similar power and, therefore, must rely on financing projects through the county government.

Table 5 indicates the financial condition of each unit of government in 1969.

TABLE 5

Financial Status of County Government and Incorporated Cities

Custer County 1969*

	<u>Revenue</u>	<u>Expenditures</u>	<u>Assessed Valuation</u>
Custer County	\$4,221,451.34	\$4,533,861.25	\$46,695,522.00
Ismay	581.88	436.33	88,552.00

* There are several methods presently available to communities for financing water and sewer systems:

1. Incorporated Cities and Towns may use Municipal Bonds, Municipal Revenue Bonds, and Special Improvement District Bonds.
2. Unincorporated Towns may use Rural Special Improvement District Bonds and County Water and Sewer District Bonds.
3. Incorporated Cities and Towns and adjacent unincorporated areas may use Metropolitan Sewer District Bonds.

Source: Information received from each governmental unit

THE WATER RESOURCES

General

The water resources of any area are one of its most important assets. Montana is fortunate in that water is in abundant supply over much of the state. This is especially true in the mountain areas and along the major drainages. Water is essential for many human needs with individual consumption and sanitation being foremost. Industrial and agricultural uses of water are perhaps next most important. The recreational use of water has also become a significant factor in modern day living.

In his use of this resource, man in the past has polluted much of the available fresh water and degraded it to the point where it is unfit for many or all uses. Careful planning for the efficient use of water resources can avert inconveniences caused by pollution.

Water resources, therefore, are an important consideration in the comprehensive planning for community water and sewer system following portion of this report the existing water resources of the planning area will be briefly reviewed. The discussion will be specifically concerned with the occurrence and availability of both surface and ground water. Also important, and included in Appendix I, are the specific laws and policies of the State of Montana concerning surface and ground-water resources. "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" adopted by the State Department of Health are discussed in detail. Table A in Appendix I outlines present day water quality standards as set forth by the United States Health Service.

Surface-Water Resources

Custer County has an extensive drainage system which has primary characteristics of plains topography. Drainage may be found flowing in almost any direction; however, the main drainage pattern is toward the Yellowstone River valley in northwestern Custer County.

Elevation differences are not excessive and the complex surface drainage system is attributed to the extremely hilly topography. In general, elevations above three thousand feet occur throughout northern and southern Custer County and the lowest elevation, less than 2,500 feet above sea level, occurs where the Yellowstone River enters Prairie County northeast of Miles City.

The major drainage features of Custer County are the Yellowstone,

Tongue, and Powder Rivers. The Yellowstone River enters Custer County southwest of Miles City and flows northeast across the county for more than forty miles before entering Prairie County. The Tongue River enters Custer County near the southwest corner of the county and flows northeast to its confluence with the Yellowstone River at Miles City. The Powder River enters Custer County near the southeast corner of the county and flows in a northerly direction to its confluence with the Yellowstone River in Prairie County near Terry. These three rivers and their tributaries provide drainage for all of Custer County.

The above streams provide a yearlong source of water for irrigation, livestock, and domestic needs. These streams have had, at various times, gaging stations installed by the United States Geological Survey (U. S. G. S.) where flow measurements are taken and recorded at regular intervals. Table 6 includes available data on the drainage area, discharge, and runoff for gaging stations on the Yellowstone River below the Tongue River at Miles City, the Tongue River at Miles City, and the Powder River near Locate.

Many small reservoirs in Custer County add significantly to the agricultural and especially the irrigational use of water in the county. As is the case in most counties in Montana, there are no records for small reservoirs published by the U. S. G. S. The Montana Water Resources Board, however, has compiled and published a list of reservoirs which store fifty acre feet or more of water. Where information was available, data for privately owned dams and reservoirs was also included. One large irrigation reservoir, the Tongue River Irrigation Reservoir located on the Tongue River in Big Horn County, is used for supplemental irrigation along the two hundred miles of the Tongue River valley to its mouth. A total of approximately thirty thousand acres are benefited by the project. The reservoir has a storage capacity of 73,900 acre feet. Irrigation facility information for Custer County can be found in the "Water Resources Survey" for Custer County published by the Montana Water Resources Board in 1948. This information and other related irrigation facility information can be obtained from the Water Resources Board in Helena, Montana.

The climate does not have the extreme variable pattern common to the more mountainous western counties of Montana. Precipitation averages do vary across the county; however, a significant pattern is not apparent. For example, records of precipitation at Miles City indicate annual averages of approximately thirteen inches; whereas, the community of Mizpah on the Powder River in eastern Custer County recorded a 1969 precipitation total of 14.95 inches. Other 1969 figures for Custer County include 12.17 inches at Volberg and 11.89 inches at Powderville just across the southern Custer County border in Powder River County. The precipitation history in Custer County

TABLE 6

Stream Gaging Stations

Stream	Gaging Sta. Location	Drainage Area (sq mi)	No. of Gages	Discharge (cfs)			Years Averaged	Runoff-(1000 Acre-Ft)		
				Max.	Date	Min. Date		Max.	Date	Min. Date
1. Tongue River	At Miles City	5,379	1,2	13,300	6/15/62	No Flow	Summer 1940	493.4	1947	119.0 1940
2. Yellowstone River	Below Tongue River at Miles City	48,253	1,2	96,300	6/19/44	996	12/14/32	12,090	1943	4,229 1934
3. Powder River	Near Locate	13,194	1	31,000	2/19/43	No Flow	At Times	1,184	1944	246.6 1956

Source: U. S. Geological Survey Water Supply Papers and
"Surface Water Records of Montana"

Notes: 1. Irrigation diversions occur above these stations.

2. Flow is regulated by one or more reservoirs

* Not Recorded

is one of annual variation. Weather Bureau records at Miles City report annual precipitation as low as 6.06 inches and as high as 22.75 inches. It is important to note, however, that the majority of the annual precipitation falls during the growing season of April through September.

In general, precipitation occurs as steady rains in the spring months of April through June, intermittent showers throughout the summer and early fall months, and as snowfall during the winter months. Snowfall is generally light and does not tend to remain on the ground for long periods of time. Winter warming spells producing thawing temperatures throughout the county are not uncommon.

The use of surface water is widespread for domestic, agricultural, and recreational purposes. The community of Miles City uses water from the Yellowstone River as a portion of its municipal supply. (See Table 7 for a chemical analysis of this water supply.) Agricultural uses of water are very important to the county, and the 1964 Census of Agriculture indicates that over 29,000 acres were being irrigated at that time. This denotes a substantial increase over the 25,000 acres which were being irrigated in the previous census year of 1959. A final but important use of surface water is for recreational purposes. The ponds, reservoirs, and streams in the county are ideal habitat for fish and waterfowl and draw many fishermen and hunters to the area each year.

Water Use Classifications

The Water Pollution Control Council has classified the streams and drainages in Montana according to the water use classification definitions shown in Appendix I. The streams and drainages of Custer County and surrounding areas are classified as follows:

Yellowstone River drainage from the Billings water supply intake to the North Dakota line except the tributaries listed below:	B-D ₃
Pryor Creek drainage	B-D ₁
Big Horn drainage above but excluding William's Coulee near Hardin	B-D ₁
Big Horn drainage from and including William's Coulee to the Yellowstone River except the Little Big Horn listed below:	B-D ₂

Little Big Horn drainage above and including Lodge Grass Creek near Lodge Grass	B-D ₁
Remainder of the Little Big Horn drainage	B-D ₂
Tongue River (mainstem) from Tongue River Reservoir to but excluding Prairie Dog Coulee	B-D ₂
Remainder of the Tongue River drainage	B-D ₃
Fox Creek drainage near Sidney	B-D ₂

Ground-Water Resources

Ground water is used extensively in Custer County for stock and domestic purposes. In many parts of the county ground water is the only available source of water. As of January 1970, the Montana Bureau of Mines and Geology had 923 appropriations for wells and ninety nine appropriations for springs in its files for Custer County. A total of 504 wells were appropriated for stock use, 121 for domestic use, 223 for both domestic and stock use, thirty seven for irrigation, twelve for commercial use, and twenty six for various other uses. A total of fourteen springs were appropriated for stock use, one for domestic use, one for both stock and domestic use, one for irrigation, and one for commercial use; fifty four uses were not reported. The town of Miles City has one well appropriated for municipal use to supplement the town's surface-water supply. (See Table 7 for chemical analyses of these water supplies.)

There are three technical reports that discuss ground water in parts of Custer County. These reports are as follows: Taylor, O. James, 1968, Ground-water resources of the northern Powder River valley: Montana Bureau of Mines and Geology Bull. 66, 34,; Taylor, O. James, 1965, Ground-water resources along Cedar Creek Anticline in eastern Montana: Montana Bureau of Mines and Geology Mem. 40, 99 p.; Torrey, A. E., and Swenson, F. A., 1951, Ground-water resources of the lower Yellowstone River valley between Miles City and Glendive: U. S. G. S. Circ. 93, 72 p.

Geologically, Custer County is underlain by a sequence of relatively flat lying sedimentary rocks. Formations of importance to the ground-water resources of the county are the Fox Hills and Hell Creek Formations of Upper Cretaceous age (65 million to 100 million years old), Fort Union Formation of Tertiary age (one to 65 million years

old), and alluvium and terrace deposits of Quaternary age (less than one million years old).

TABLE 7

Chemical Analysis of Municipal Water Supplies
(All Figures in Milligrams per Liter)*

<u>City or Town</u>	<u>Miles City</u>	<u>Miles City</u>
Source	Yellowstone River	Soda Well
Date	1/69	1/69
Total Solids	572	854
Hardness	290	40
Ca	68	4
Mg	29	7
Na+K	84	327
CO ₃	0	27
HCO ₃	235	750
SO ₄	228	49
Cl	14	28
NO ₃	2.2	0
F	0.28	1.32
Fe	0.1	0.0
As	0.002	0.0
Pb	0.0	0.0
Cu	-	-
Zn	-	-

* See Appendix I, Table A, for accepted water quality standards

Source: State Department of Health, Helena, Montana

The deepest formation used for supplying ground water in Custer County is the Fox Hills Formation. The Fox Hills is not exposed at the ground surface in the county. The Fox Hills consists of an upper part, called the Colgate Member, which is about forty feet thick, and a lower, unnamed member consisting of fine to medium grained, light colored sandstone. The lower part of the Fox Hills is about one hundred to 250 feet thick. The Fox Hills yields adequate amounts of water to numerous wells for stock and domestic use. The quality of the water is fair and the water is soft. Depth of the Fox Hills

varies throughout the county, but it is commonly about eleven hundred feet deep.

The Fox Hills Formation is underlain by about one thousand feet of dark colored marine shale that contains little, if any, potable water. Overlying the Fox Hills Formation is the Hell Creek Formation consisting of about six hundred feet of sandstone, shale, mudstone, and siltstone. The Hell Creek Formation is exposed along the Powder River in southeastern Carter County. The basal Hell Creek Sandstone is in contact with the Colgate Member of the Fox Hills Formation, and together they form a relatively thick and continuous sandstone aquifer. The upper part of the Hell Creek furnishes small amounts of hard water to wells, and the basal sandstone supplies small to moderate amounts of soft water to numerous wells. Water in wells in the Hell Creek-Fox Hills aquifer is under artesian pressure and in some areas will produce flowing wells.

The Fort Union Formation overlies the Hell Creek Formation and is exposed over most of Custer County. The Fort Union has been divided into three members in eastern Montana; a lower member called the Tullock, a middle member called the Lebo Shale, and an upper member called the Tongue River. The contact between the Lebo Shale and Tullock Member is difficult to distinguish and the name Ludlow Member has been used for the lower part of the Fort Union rather than Tullock and Lebo. The lower part (Ludlow Member) of the Fort Union consists mainly of dark colored shale with a few interbedded sandy shales and several zones containing concretions. The thickness of the Ludlow Member is about three hundred to five hundred feet. This member will yield small amounts of poor quality water to wells.

The upper part of the Fort Union Formation (Tongue River Member) is lighter colored and more sandy than the lower part. Beds and lenses of coal are common in this unit. The Tongue River Member contains interlayered beds of shale, sandstone, and siltstone. Thickness of this member ranges from zero to four hundred feet. The lower part of the Fort Union is exposed in the southeastern part of the county. The Fort Union thickens westward, but the contact between the Tongue River Member and Ludlow Member is poorly defined. Ground water is present in both members of the Fort Union but is much more abundant in the Tongue River Member. Most wells are drilled 150 to two hundred feet into the Tongue River to obtain water for domestic and stock purposes. Many wells in the Fort Union are artesian, and some wells flow. Coal beds in the Fort Union often supply water to wells. Quality of water from the Fort Union is generally poor to fair.

Along the Yellowstone River there are a number of well developed stream terraces. They are composed of sand, gravel, and silt and are

about ten to 250 feet above the river. Adequate water supplies for stock and domestic use can usually be obtained from wells in the more extensive terrace deposits. Irrigation of the lower terraces has provided considerable recharge to ground water in the terrace gravels. Quality of water from the terraces ranges from fair to good, but due to rapid recharge ground water in some parts of the terraces may be subject to pollution.

Along major streams in the county there are alluvial deposits of Quaternary age. The alluvium is composed of unconsolidated mixtures and layers of sand, gravel, silt, and clay. Alluvium along the Yellowstone River has a maximum thickness of about fifty feet and will yield moderate to large quantities of water for wells. Numerous private wells are drilled into the Yellowstone alluvium. Along the Powder and Tongue Rivers the alluvium is generally thinner than along the Yellowstone but may be capable of moderate to large water yields in some areas. Adequate supplies of fair to poor quality water are available from the alluvium for stock and domestic purposes.

In summary, the Tongue River Member of the Fort Union Formation, the Fox Hill-Hell Creek aquifer, and alluvium and terrace deposits along the major streams are the sources of almost all ground water used in Custer County. There will be continued development of water for stock and domestic purposes. There may be some additional development of ground water in alluvium and terrace deposits for municipal and irrigation use. Additional detailed hydrogeological studies are needed in the county to assist in future ground-water developments.

- Sources:
1. M. K. Botz, Montana Bureau of Mines and Geology, Butte, Montana, 1970
 2. State Department of Health, Helena, Montana
 3. U. S. G. S. Water Supply Papers and "Surface Water Records of Montana"
 4. "Water Resources Survey," Custer County, Montana, Montana Water Resources Board, Helena, Montana, 1948
 5. Weather Bureau, Climatological data, Montana Section, 1969

THE SOILS

General

General descriptions of soils in specific areas are useful in predicting the potential problems which might be encountered during private and public works construction. Custer County has an interesting and complicated geological history which has greatly influenced the soil structure of the area. The effects of widespread and varied down cutting of streams are represented in the physiographic features of the county. Custer County is actually a part of the plains area of eastern Montana; however, the entire county is characterized by rough broken land and a complex surface drainage system.

Weathering and erosion of sedimentary rocks in Custer County has resulted in the odd land forms and badlands which now exist. Coupled with erosion, extensive drainage throughout the area over periods of time has resulted in the filling of most stream valleys with alluvium. Thus, the soils of Custer County are made up of alterations of sedimentary parent materials and alluvium due to various conditions of climate, topography, and living organisms.

Soil Map

The Soil Conservation Service of the United States Department of Agriculture is currently engaged in a detailed soils study of each county in Montana in an effort to produce general soil maps for each county. The detailed study of Custer County is not complete at this time, and a general soil map is not available. Detailed information concerning specific areas in the county can be obtained from the Soil Conservation Service office in Miles City. This office should be contacted for soil information in areas where construction projects are planned.

A publication entitled "Soils of Custer County" issued in October, 1953, is available from the Agricultural Experiment Station in Bozeman, Montana. This bulletin is part of a soil reconnaissance of Montana completed by L. F. Geiseker in cooperation with the Soil Conservation Service. The bulletin contains very little information on the engineering properties of soils, but it does provide a preliminary general soil map with brief soil descriptions. The map, revised somewhat for clarity following reduction of scale, is shown in this report as Map 4. The soil descriptions give a general idea of existing conditions in Custer County, and it must be realized that this information is only preliminary to the more detailed study currently being conducted. More detailed descriptions of individual

soils can be found in the bulletin, and it is recommended that the services of the Soil Conservation Service soil scientists be utilized for interpretive information on specific soil characteristics.

Brief descriptions of the general soil areas shown on the map are as follows:

1. Bainville Soils. Bainville soils have developed from calcareous, massive siltstone and sandy shale of the Fort Union and Lantz geologic formations. These soils have silty to friable clay loam subsoils grading into disintegrated siltstone or sandy shale at various depths. These soils are thin and have most of the characteristics of the slightly altered parent material found at shallow depths. They occur chiefly in the sharply rolling uplands in different parts of the county.

2. Cushman Soils. Cushman soils in Custer County have developed in a similar manner and have most of the same characteristics of the Bainville soils. The Cushman soils are the most extensive agricultural soils in Custer County and cover undulating to gently rolling uplands in the northern part of the county and rolling to sharply rolling uplands on the higher divides in the south central part.

3. Flasher Soils. The soils of the Flasher series have formed over calcareous sandstones of the Lantz and Fort Union geologic formations in the area. These soils have sandy subsoils, grading into disintegrated sandstone with depth.

4. Larimer Soils. The Larimer soils are developed over gravelly outwash such as that found on the slopes of the Mountain Sheep Bluffs in the northwestern part of the county where they have well defined gravelly carbonate horizons and gravelly subsoils, but are underlain at comparatively shallow depths by siltstone. The soils on the dissected gravelly borders of the benchlands along the larger stream valleys are Larimer soil material.

5. Lismas Soils. The soils of the Lismas series have developed on shaly members of the Lantz and Fort Union formations such as the Hell Creek, Tullock, and Lebo. The soils have dense clay subsoils, grading into disintegrated shale with a depth. The grayish brown soils of the Lismas series cover the more broken shaly uplands in the central part of the county.

6. Orman-Patent Soils. The soils developed in Colluvial-alluvial material on the slopes of the ridges and stream valleys are also separated on the basis of color of the surface soil and the consistence of the subsoil. The total areas of these soils is large,

but, because of their intricate association with other soils and their irregular pattern, only the larger areas can be shown on the soil map.

7. Terry-Vebar Soils. The soils of the Terry and Vebar series are formed similarly to the Flasher series previously described. The Terry soils chiefly occupy tracts of gently rolling uplands in the northeastern and southeastern parts of the county. The dark brown Vebar soils have developed on the high sandstone capped ridges or divides in the central part. The Terry soils are described as fine sandy loams and loam and the Vebar soils are fine sandy loams.

8. Wibaux Soils. The Wibaux soils have been derived from weathered scoria in the northeastern, southeastern, and northern parts of the county. The Wibaux soils cover most of the scoria capped buttes.

9. Winnett Soils. The Winnett soils developed in the central and southeastern part of Custer County are underlain by the Tullock interbedded sandstone, siltstone, and shale. Soils of the Winnett series have well defined claypan subsoils. They occupy most of the more gently rolling uplands.

10. Badlands. The rough broken land or badlands is divided into several groups according to the predominating character of the geologic material. The general soil map indicates the badlands as one area, however.

11. Alluvial Soils. The soils of the stream valleys are described as (1) high bottom alluvial soils, undifferentiated, chiefly medium textured soils; (2) high bottom alluvial soils, undifferentiated, chiefly heavy textured soils; and (3) low bottom alluvial soils, undifferentiated. All alluvial soils have been shown on the general soil map as occupying one area. Many of these soils are clays and clay loam with subsoils ranging from friable clays to dense clays.

Conclusions

The soils of Custer County have a wide range of characteristics; however, they generally have been easy to deal with where shallow domestic water wells and individual sewage drainfields have been constructed. The large amounts of alluvium and other surface deposits have been found to be extremely variable in permeability, however. This has had an effect on both the quantity of water available in shallow domestic wells and the successful operation of individual sewage drainfields. Because average permeability of the extensive clay and silt deposits ranges from moderate to poor, special care is

required in the construction and operation of septic tank drainfields in these soils.

Construction of municipal water and sewer systems in the various soils of Custer County has not been found to be difficult. Pipeline trench digging in the sands and clays is extremely easy while the coarse alluvium or stream gravels slow operations somewhat. Bedrock at shallow depths is not common in the valley bottoms; however, it can be expected at normal water and sewer line installation depths in specific locations. Detailed soil information should be obtained before project planning and construction cost estimating are begun.

Also, on site soil investigations should be performed.

- Sources: 1. "Soils of Custer County," L. F. Geiseker, Montana State College Agriculture Experiment Station, Bulletin 489, Bozeman, Montana, October, 1953
2. U. S. Department of Agriculture, Soil Conservation Service, Miles City, Montana

COMMUNITY WATER SYSTEM FACILITIES

General

This comprehensive report covers the overall problems, existing or projected, for Custer County, Montana. The volume of data processed and evaluated and the intent of the report allow only a general analysis of any one system.

The intent of this report is to point out the general needs of each community with the objective that each community may in the future be provided with a safe and adequate water system. The general solutions to overall problems suggested in this report may have to be modified when detailed studies are made. These modifications may be in exact size of parts of a system or in some detailed design variation but will not detract from the overall value of the general information presented.

Basically, the demand for water from community systems is for domestic, fire fighting, and industrial uses. The demand for industrial water supply in small communities has not been extensive in Montana, and in most cases will not control the design of community systems. Sufficient water for fire fighting must be considered; however, economic feasibility will usually control the extent of such facilities. In most small communities a system with sufficient

capacity to give high ratings for fire protection would require facilities considerably larger than necessary for domestic purposes. The community might be unable to finance such an improvement; the approach, therefore, has been to propose a system suitable for present domestic needs. These basic facilities can be expanded for more complete service and for higher fire ratings as it becomes economically feasible.

The domestic use of water has increased greatly in recent years. This is partially due to improved economic conditions which make it possible for families to acquire such water consuming appliances as dishwashers, waste disposal units, and automatic washing machines. Water use for beautifying property has also increased. The most essential condition is adequate, safe, and potable water for domestic purposes, and this has been the primary consideration in this study. See Appendix II for further comments on analysis criteria.

Basic Considerations

Communities studied in this comprehensive plan were those with a minimum of five potential users and a maximum population of 5,500. Each community within this category was visited at least once. During these visits the type of water facilities available was examined, and an evaluation of the facilities was made from the standpoint of fulfilling the needs of the residents.

The existing systems were found to be quite varied in their operation, condition, and suitability for serving the needs of the users. The situation in each community was evaluated separately; however, some general classification of the various systems was possible. These are described briefly in the following paragraphs so that the general philosophy of the analysis can be shown.

1. In some communities the homes are quite widespread and few in number. Good water in adequate quantities can be found at reasonable depths, and for such situations private wells will provide a safe and suitable water system.

2. Many communities have had access to good water from private wells for many years. In some of these communities population is increasing, and the area is becoming more densely settled. As a result, tests for bacteriological quality of well water occasionally indicate that pollution is present. When this occurs, it is usually the beginning of a problem which will continue to worsen. Increasing population and a higher potential for contamination indicate the need for a safe community water facility. The system should be one which will serve the domestic needs of the present residents with provisions

for improvements and expansion as needed.

3. Many communities have enjoyed a central water system for years but have not made annual improvements and replacements. This has resulted in overloaded and antiquated systems. Suggestions for immediate improvements which will fit into an overall replacement program are included in this report.

4. Some communities which have experienced a steady population growth are finding that their water systems are inadequate for present demands and will require enlargement. Population projections and economic trends are used to determine the need for improvements and also to justify the type and extent of proposed improvements.

Custer County

The estimated 1970 population of Custer County is twelve thousand. At the present time approximately 8,922, or seventy four percent of these people, are served by the central water system in Miles City, and the remainder are served by private facilities such as wells and springs. By 1990 the people living in Ismay will also have access to a central water system if the schedule of proposed improvements is followed. It is expected that the remaining population will live in outlying areas, and the homes will not be close enough together to make central systems feasible.

Ismay

Existing System. The estimated 1970 population is fifty. Population projections indicate that the town will decrease in population throughout the planning period. The people of Ismay obtain their water from individual wells. Water obtained from these wells is of good quality and is quite soft; however, it is somewhat gaseous. Wells in the area are artesian and range in depth from four hundred to over one thousand feet. Plenty of water is available to supply the needs of this community through these wells, and there has been no consideration of the construction of a central water system. The layout of the community of Ismay is such that a central water system could feasibly be constructed.

Improvements by 1990. The population of Ismay is expected to be twenty by 1990. The installation of central water and sewer facilities during the planning period could avert this decline in population. Should the local demand for improved facilities develop during this period, a water system as shown on Map 5 would adequately serve the needs. A well capable of producing twenty five gallons per

minute (gpm) could be developed at a location within the community, and storage for the system could be provided by a ten thousand gallon tank located on a hill north of the community. The water distribution system consists of four inch diameter pipe which would be adequate to supply required flows and pressure for the needs of the community through the planning period.

Kinsey

Existing System. The estimated 1970 population of Kinsey is ten. This population is expected to decline slightly throughout the planning period. The residents presently obtain their water supply from private artesian wells which provide water in adequate quantities although there is some sulphur taste. Depth of the wells in this area are four hundred to five hundred feet, and there have been no pollution or contamination problems reported. It is not believed that any type of central water system is feasible at this time or throughout the planning period. The present use of private wells will result in an adequate water supply for the community needs.

COMMUNITY SEWER SYSTEM FACILITIES

General

Each use of water adds some material or alters some characteristic enough to change the original quality of the water and often to pollute it. The transportation and dilution of municipal, industrial, and agricultural wastes are important and necessary uses of water; therefore, special emphasis is placed on the control of water pollution from these sources. Some of these wastes can be carried in limited amounts without damage to the resource. Some wastes if discharged into water courses can make their way into underground aquifers and pollute the ground water so that it is unsuitable for further use.

Pollution by definition and interpretation is a matter of degree. Since it is inevitable that the quality of water will be altered with each use, it is of critical importance to control the degree of pollution.

It is public policy established by the state legislature to maintain reasonable standards of purity for the water of the state. These standards are to be consistent with the use of these waters, including their use in carrying away the water borne waste products of society. The current Federal Water Pollution Control Act in reference to

pollution abatement gives the individual states discretion in assessing the physical and economic feasibility of complying with water quality standards. The "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" of the Montana Water Pollution Control Council for streams and rivers in Montana have been included in Appendix I.

Sewage may be broadly categorized as domestic or municipal waste, industrial waste, and animal or agricultural waste. Animal wastes are usually not involved in community sewage facilities; however, they do constitute a potential source of pollution which must be controlled and prevented from entering streams or other potential water supplies.

Although industrial activity throughout Montana has been limited, the need for control and treatment of industrial wastes is apparent. Industrial wastes vary in quantity and composition as greatly as the products and processes which generate them. They include toxic chemicals, solids carried in suspension, brines, strong acids and alkalis, oils, dyes, floating solids, and the heat generated by industrial processes. Industrial wastes are not found to be a major factor in the design of most community sewage facilities. Where economic projections indicate industrial development, the relationship to loading on domestic sewer systems is considered.

Domestic sewage is the primary consideration of this study and has been the basis for design and analysis. Where particular systems are subjected to loading from industrial sources, a more detailed study will be necessary. The general approaches outlined in "Analysis Criteria" in Appendix III will suffice in practically all cases.

Basic Considerations

There are generally three main methods of sewage disposal. These are septic tanks, mechanical sewage treatment plants, and wastewater stabilization ponds. Local soil conditions, availability of land, and density of population are the basic factors which govern the selection of a particular method.

Many of the smaller communities have relied on individual septic tanks and cesspools for each home to handle sewage disposal. Septic tanks are suitable if the population density is low and if the systems are properly designed and maintained. Overflow from these tanks must drain into the soil and, depending on local soil conditions, may or may not create a problem. There is a limit to the amount of water that even loose granular soil can absorb. Density of population and the length of time the effluent has been entering the soil are factors

which indicate whether septic tanks can be suitable for sewage disposal.

When economically feasible, community sewage collection and disposal systems are much more desirable than individual systems. Community systems eliminate the worry of septic tank failure, and danger of well contamination, and the problem of soil saturation. However, it is usually uneconomical to serve a few homes scattered over a large area with a community sewer system.

The type of sewage disposal facilities to be used can generally be determined on the basis of economic factors. Mechanical treatment plants provide an excellent means of sewage disposal although the initial cost, maintenance cost, and power cost are usually high. Wastewater stabilization ponds are an ideal method of sewage disposal and usually are the most economical to construct and maintain.

The Montana Water Pollution Control Council has established the criteria that treatment of domestic and industrial wastes shall be secondary treatment or its equivalent. For domestic sewage, mechanical treatment plants or stabilization ponds, when either is properly designed, constructed, and operated, meet these requirements.

A schedule for completion of secondary treatment facilities by communities across the state has been established by the State Department of Health. The target date is included for individual towns when applicable.

Custer County

In Custer County only Miles City is presently served by community sewer facilities. Approximately 8,922, or seventy four percent, of the county population are served by these facilities. By 1980 if the proposed expansion program is followed the residents of Ismay will also have access to community sewer facilities. The remaining county population will live in outlying areas, and the homes will not be close enough together to make community systems feasible.

Ismay

Existing System. The current population of Ismay is estimated to be fifty. This population is expected to decline steadily throughout the planning period. Sewage in the community of Ismay is handled through individual septic tanks and cesspools. Soil in the area consists of clays and sands and drainage from properly installed drainfields is satisfactory. No pollution or contamination is

apparent from these individual systems; however, it is noted that the possibility of contamination of the ground-water table from the effluent of many shallow drainfields exists. Individual sewage disposal systems have served this community adequately in the past, and there has been no consideration of the construction of a central sewage facility.

Improvements Next Five to Ten Years. By 1975 the population of Ismay is expected to be forty five. The installation of central sewer facilities in this community may help avert the decline in population during the planning period. Individual systems may serve this community adequately during this period; however, if problems develop the population is sufficient to warrant construction of a central sewer system. A system which would serve the community adequately is shown on Map 7. A gravity collection system made up of eight inch diameter pipe would carry sewage to the proposed 0.5 acre wastewater stabilization pond located south of the community. The exact location of various facilities will depend on economic considerations and the eventual community development characteristics.

Kinsey

Existing System. The estimated 1970 population of Kinsey is ten. Population projections indicate that this population will decline to approximately seven by 1990. Sewage in Kinsey is handled by septic tanks and drainfields. The soil in the area is quite sandy, and drainage beyond septic tanks is good. The residents of Kinsey have experienced only normal operational problems with their individual disposal systems, and maintenance of these systems generally consists of periodic pumping and cleaning. It is believed that these systems will continue to serve the community adequately throughout the planning period. A central sewer system facility is not proposed for this community.

PREFACE TO MAPS

The following maps have been prepared from several sources. The county maps were prepared from Transverse Mercator Projection Series Maps and Montana Highway Department Maps, Planning and Survey Series. The reduction of the county maps necessary for this publication makes them useful for general reference purposes only.

The town and community base maps used herein are taken from Montana State Highway Commission City and Town Plats prepared from aerial photographs dated 1961 to 1969 and have been updated where necessary. On-site surveys, plats obtained from individual towns, and aerial photography conducted in 1970 were also used. Uncontrolled mosaics have been used and scales are, accordingly, only approximate and are shown for referencing purposes only. The mapping operation was supplemented by field checks made during 1970.

Land use information was obtained by field surveys, supplemented and checked by aerial photography during 1969 and 1970.

Water and sewer systems maps show existing facilities for individual towns and communities except where the information was not available. Data concerning these community facilities was obtained from the records of the individual communities and of the State Department of Health. Water and sewer lines are shown in the center of streets to indicate the existence of lines rather than precise locations. The sizes of lines, obtained from the most current information available, are indicated when possible. The locations of recommended improvements are given as relative locations and are not meant to be scaled from the individual town or community maps.

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CUSTER COUNTY LAND OWNERSHIP	3
CUSTER COUNTY SOILS	4
ISMAY WATER SYSTEM	5
KINSEY	6
ISMAY SEWER SYSTEM	7

MAP I

COUNTY MAP
GENERAL RELIEF

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

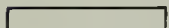
ROADS-HIGHWAYS
 STATE HIGHWAY U. S. HIGHWAY

 RAILROADS

 STREAMS-LAKES

 COUNTY BOUNDARY

 INDIAN RESERVATION

 0-3,000 FT. ELEVATION

 3-5,000 FT. ELEVATION

 5-7,000 FT. ELEVATION

 OVER 7,000 FT. ELEVATION

MAP 2

LEGEND

MAJOR STATE-WIDE COVERAGE

POWER AND GAS SYSTEMS

-  POWER PLANT (IN MEGAWATTS)
-  1 to 50 KILOVOLTS
-  51 to 100 KILOVOLTS
-  101+ KILOVOLTS
-  PROPOSED LINES
-  GAS LINES

RECREATION AREAS

1. LOST CREEK STATE PARK
 2. LEWIS AND CLARK CAVERNS STATE PARK
 3. LAKE MARY RONAN STATE PARK
 4. MEDICINE ROCKS STATE PARK
 5. ROSEBUD STATE PARK
 6. ROCK CREEK STATE PARK
 7. MAKOSHIKA STATE PARK
 8. WEST SHORE STATE PARK
 9. WOODS BAY STATE PARK
 10. BITTERROOT LAKE STATE PARK
 11. ASHLEY LAKE STATE PARK
 12. LONE PINE STATE PARK
 13. JAMES KIPP STATE PARK
 14. HOOPER MEMORIAL STATE PARK
 15. HELL CREEK STATE PARK
 16. FINLEY POINT STATE PARK
 17. ELMO STATE PARK
 18. FLATHEAD LAKE STATE PARK
 19. YELLOW BAY STATE PARK
 20. WALSTAD MEMORIAL PARK
 21. THOMPSON FALLS STATE PARK
 22. WHITEFISH LAKE STATE PARK
 23. WAYFARERS RECREATION AREA
 24. TIBER RESERVOIR RECREATION AREA
 25. CLARK CANYON RESERVOIR RECREATION AREA
 26. ENNIS RECREATION AREA
 27. DEADMAN'S BASIN RESERVOIR RECREATION AREA
 28. PAINTED ROCKS RESERVOIR RECREATION AREA
 29. CANYON FERRY RECREATION AREA
 30. LOGAN PARK RECREATION AREA
 31. NELSON RESERVOIR RECREATION AREA
 32. BEAVERTAIL HILL RECREATION AREA
 33. GLACIER NATIONAL PARK
 34. YELLOWSTONE NATIONAL PARK
-  NATIONAL FORESTS

MAP 3

COUNTY MAP LAND OWNERSHIP

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

ROADS-HIGHWAYS

———— STATE HIGHWAY U. S. HIGHWAY

— — — — RAILROADS

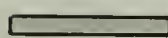
 STREAMS-LAKES

- . - . - . COUNTY BOUNDARY

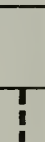
 INDIAN RESERVATION

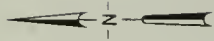
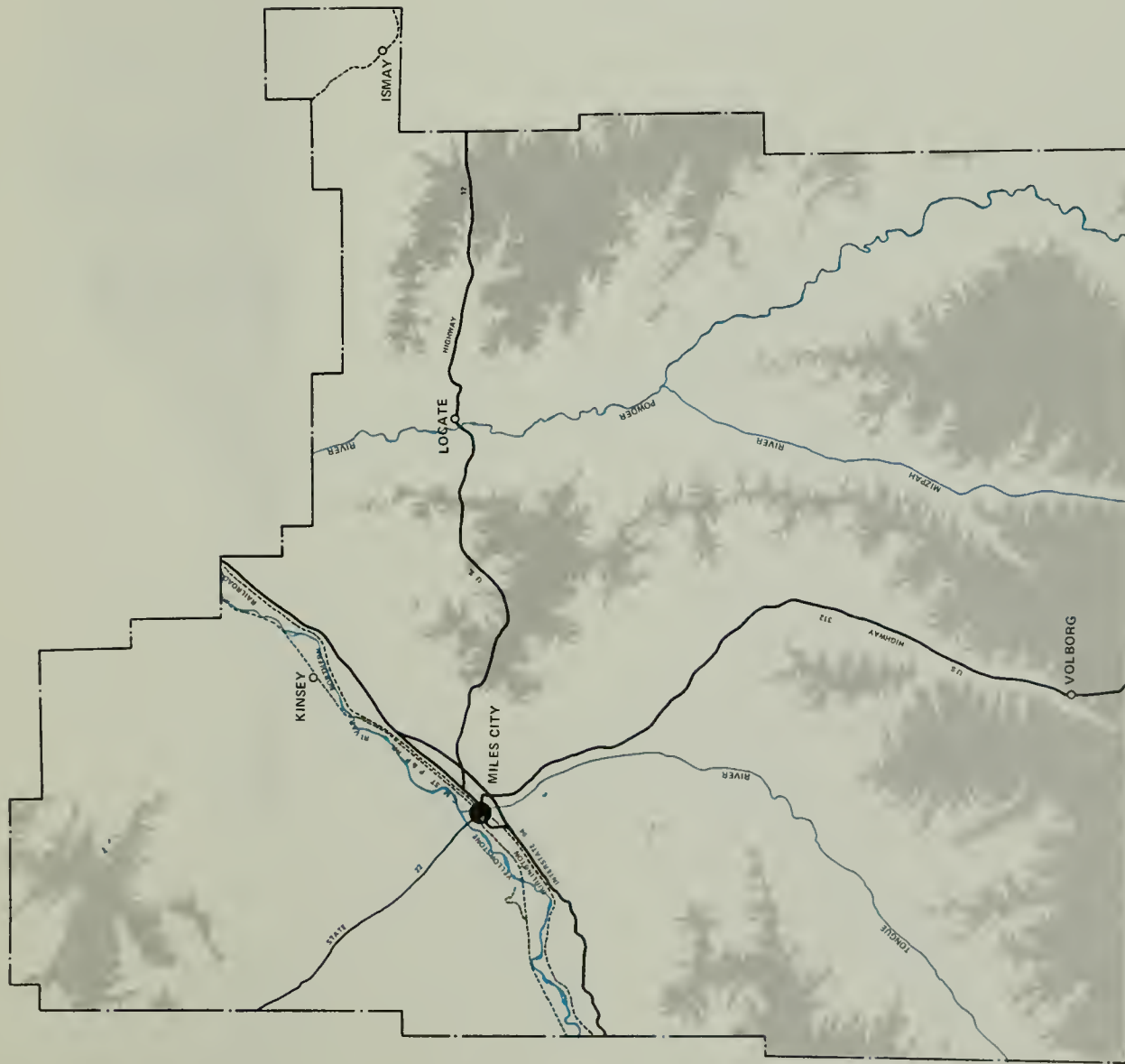
 PRIVATELY OWNED LAND

 STATE OWNED LAND

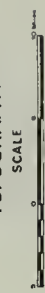
 FEDERAL OWNED LAND

CITIES MAP LEGEND

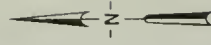
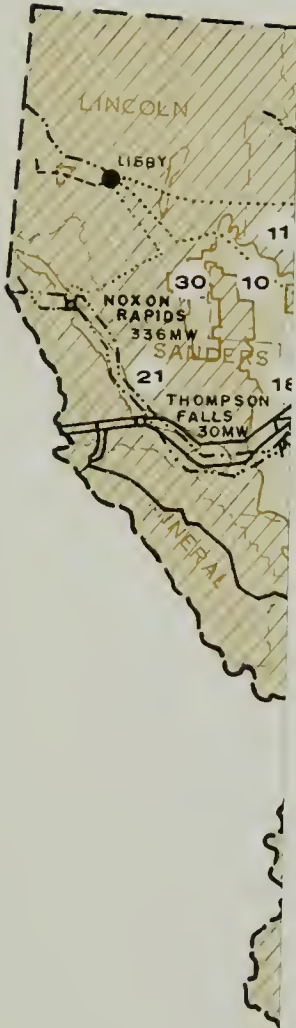
LAND USE	WATER and SEWER SYSTEMS
 SINGLE RESIDENCE	 EXISTING LINES AND SIZES
 DILAPIDATED RESIDENCE	 PROPOSED LINES 5-10 YEAR
 SINGLE TRAILER RESIDENCE	 PROPOSED LINES 10-20 YEAR
 MULTIPLE RESIDENCE	 EXISTING LIFT STATION
 APARTMENTS	 PROPOSED LIFT STATION
 TRAILER COURT	 EXISTING WATER STORAGE TANK
 COMMERCIAL BUILDING	 PROPOSED WATER STORAGE TANK
 HOTEL-MOTEL	 EXISTING WATER SOURCE
 PUBLIC BUILDING	 PROPOSED WATER SOURCE
 SCHOOL	 EXISTING TREATMENT FACILITIES
 CHURCH	 PROPOSED TREATMENT FACILITIES
 HOSPITAL	 SERVICE AREA 1970-1980
 INDUSTRIAL	 SERVICE AREA BY 1990
 GRAIN ELEVATOR	



CUSTER COUNTY
TOPOGRAPHY



MAP 1



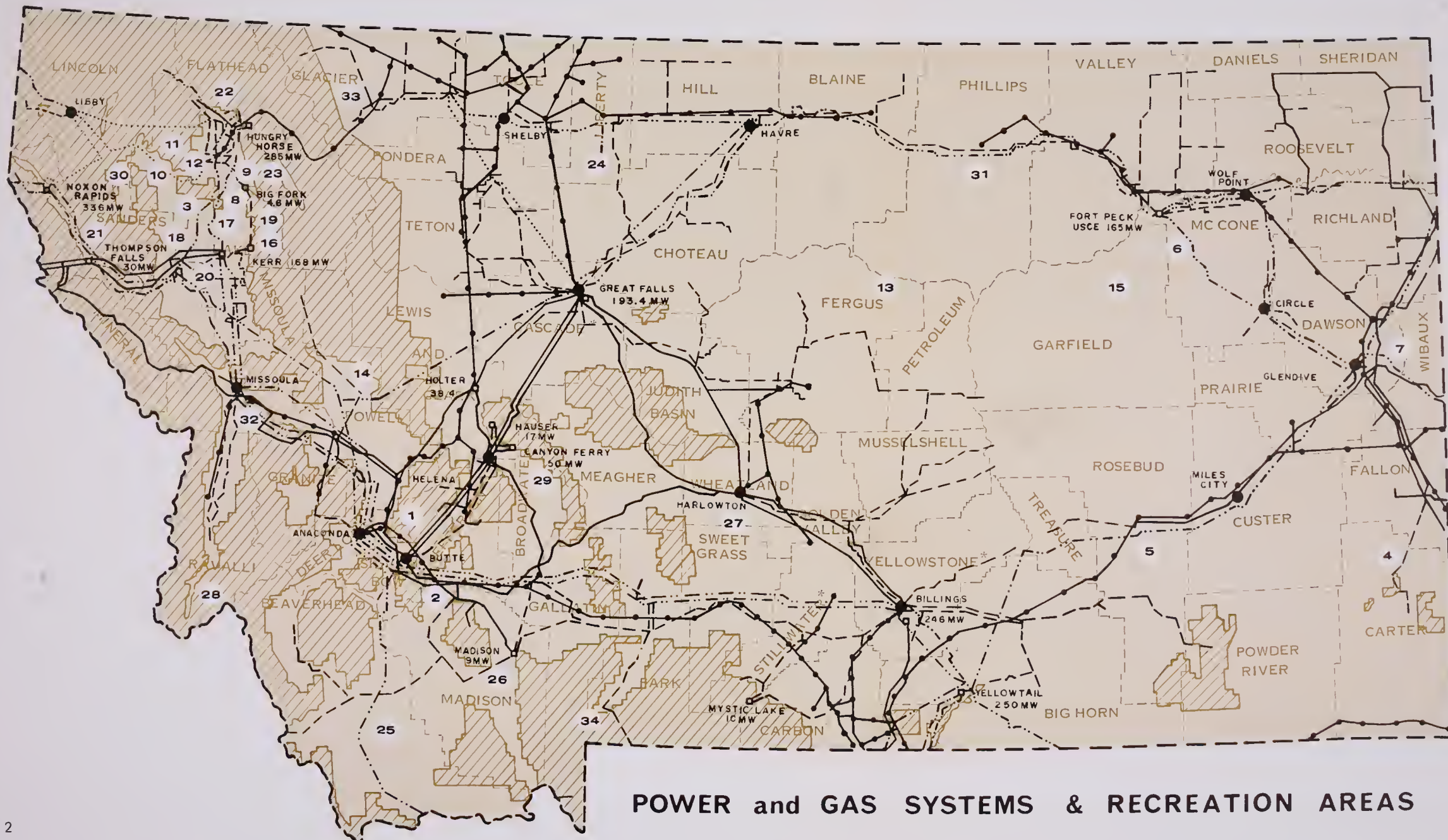
ER COUNTY

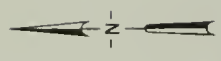
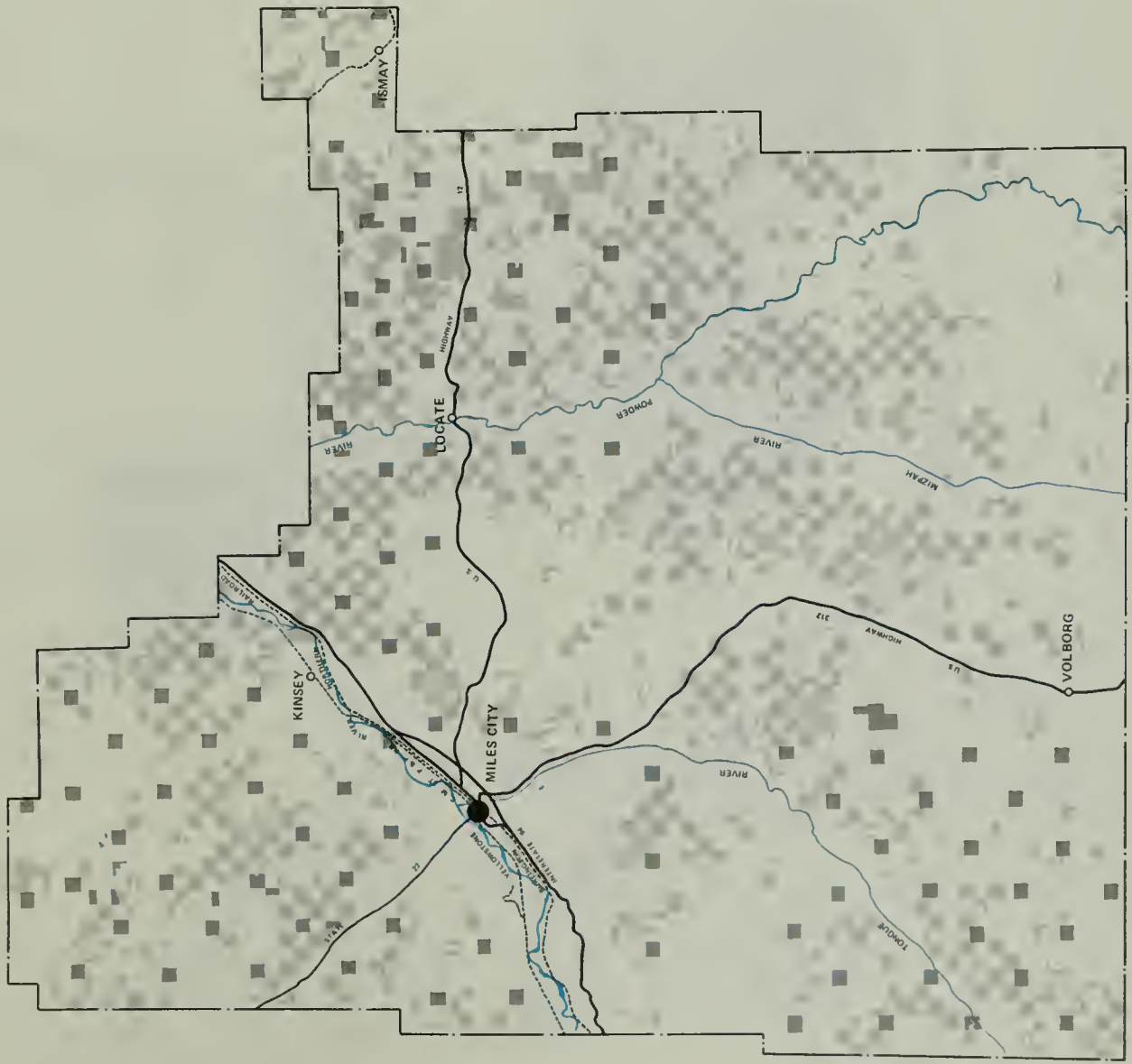
D OWNERSHIP

SCALE



MAP 3

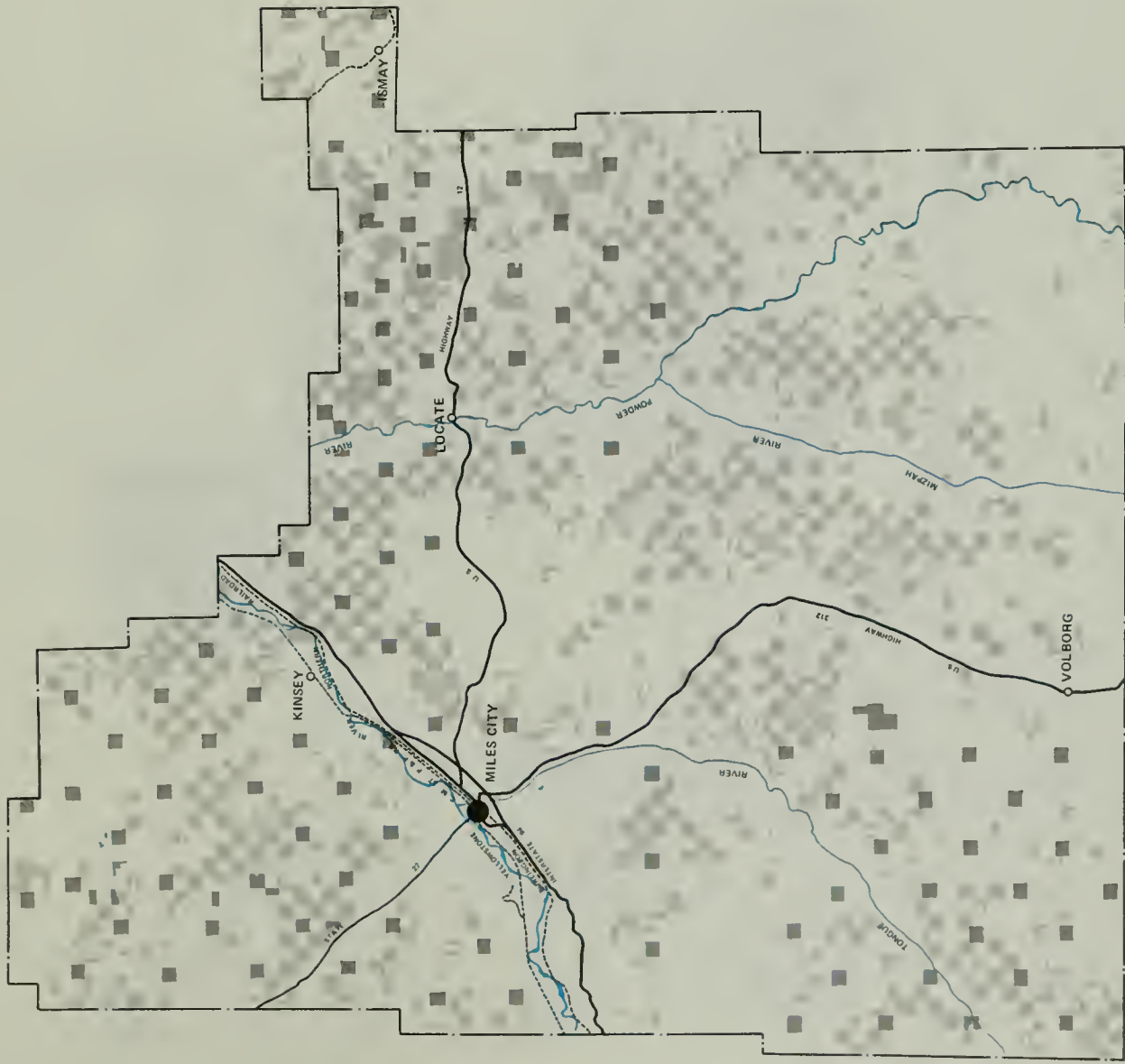




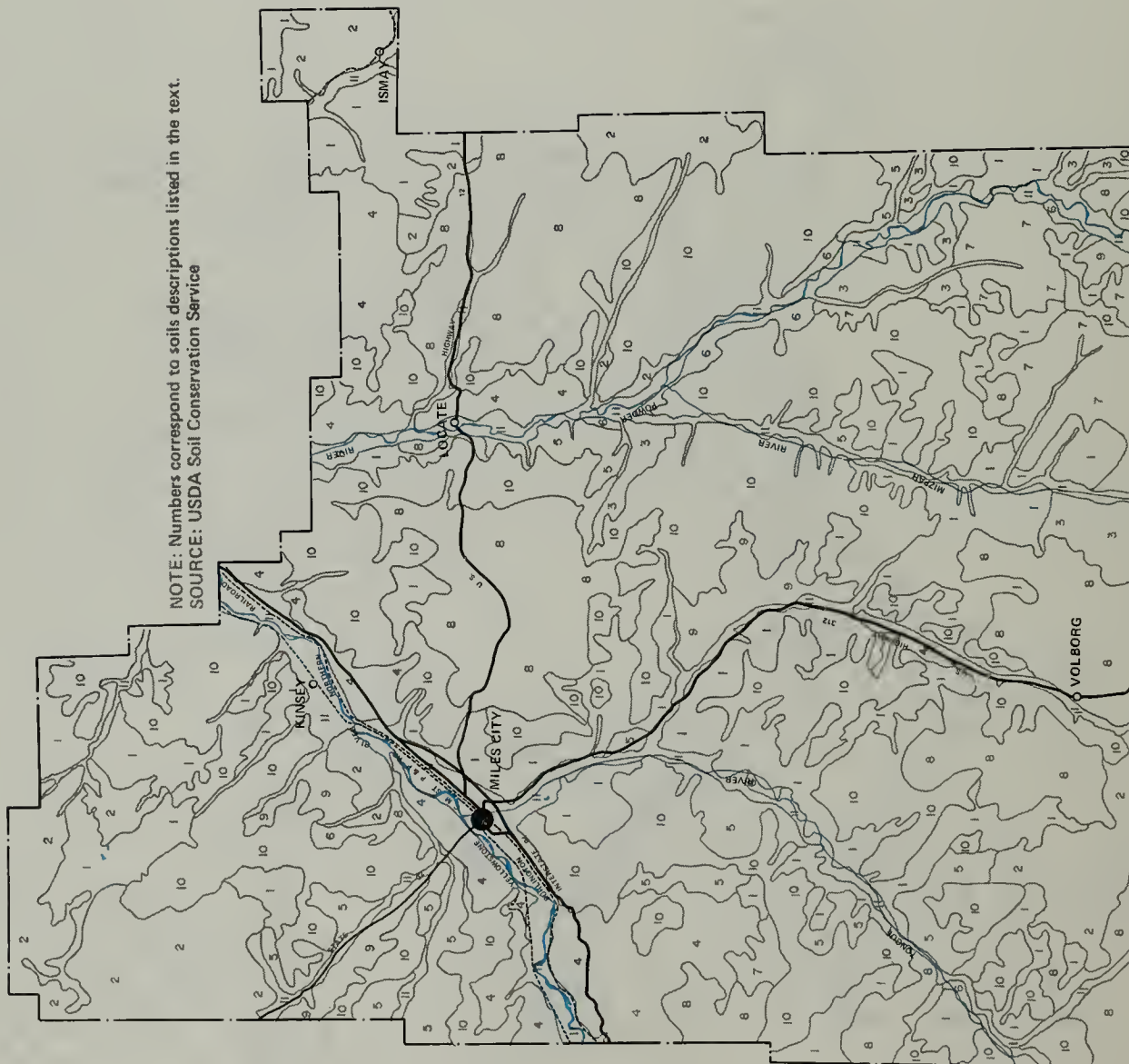
CUSTER COUNTY
LAND OWNERSHIP



MAP 3



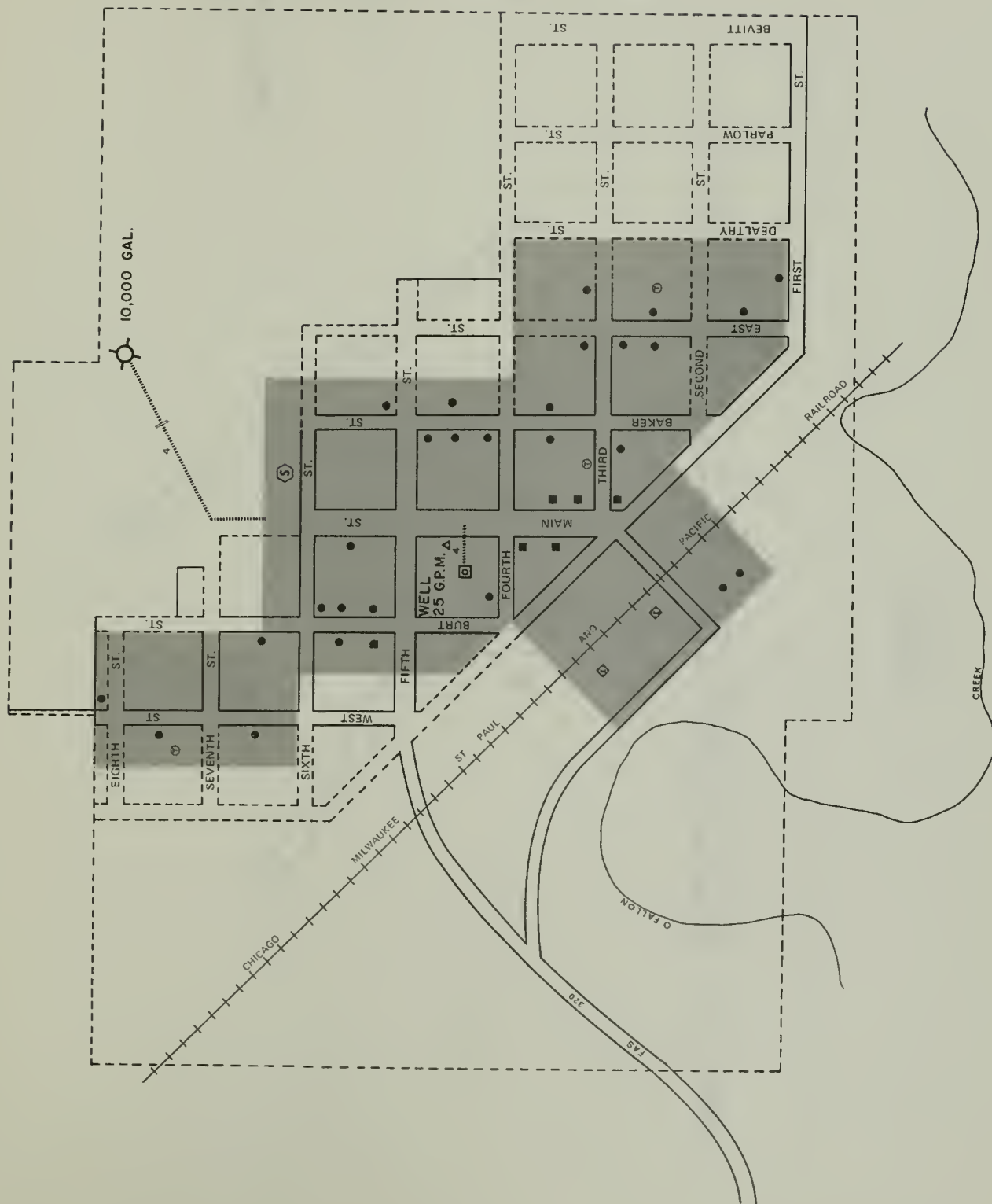
CUSTER COUNTY
LAND OWNERSHIP
SCALE
MAP 3

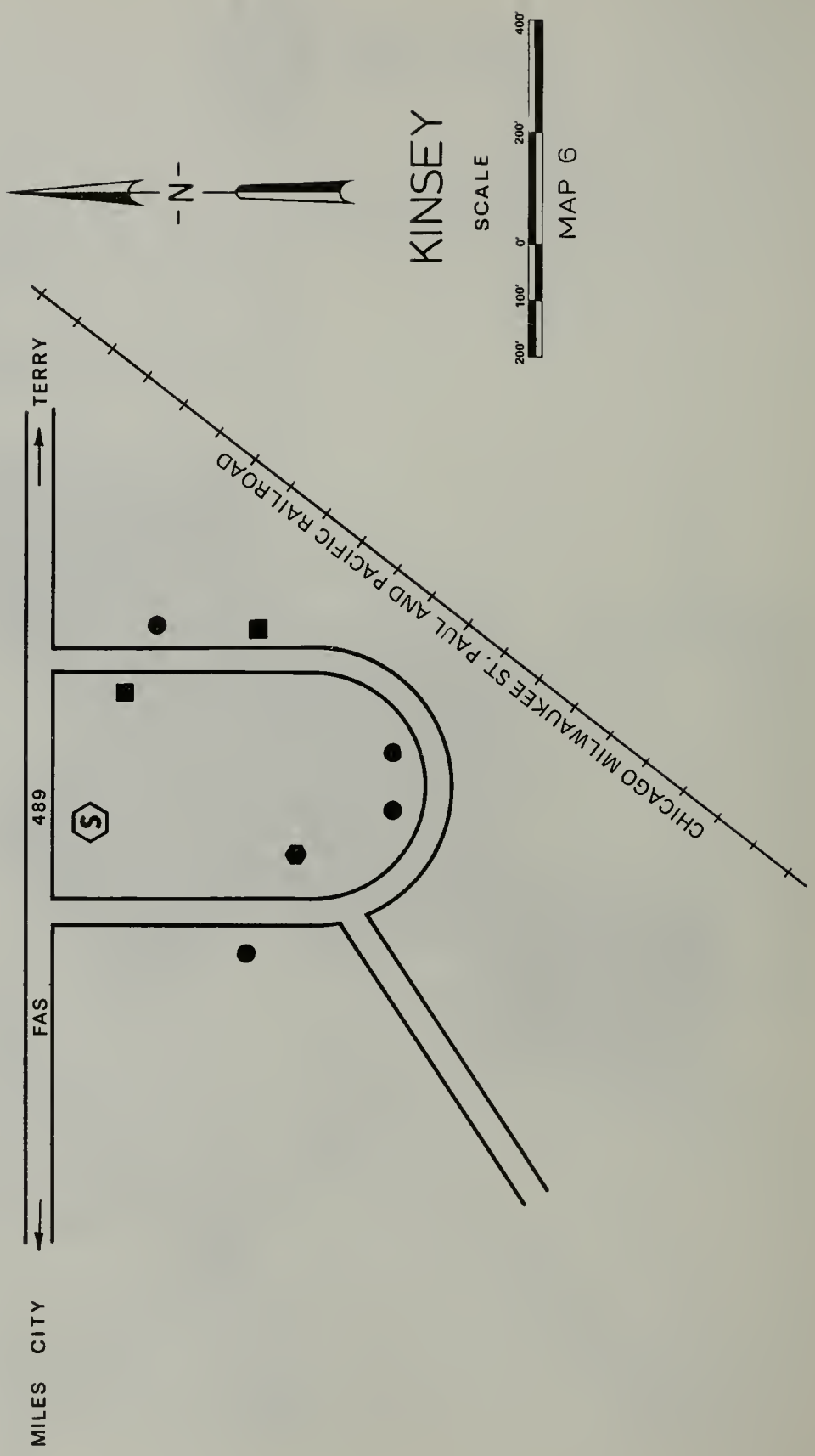


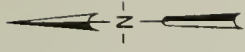
CUSTER COUNTY

SOILS
SCALE

MAP 4

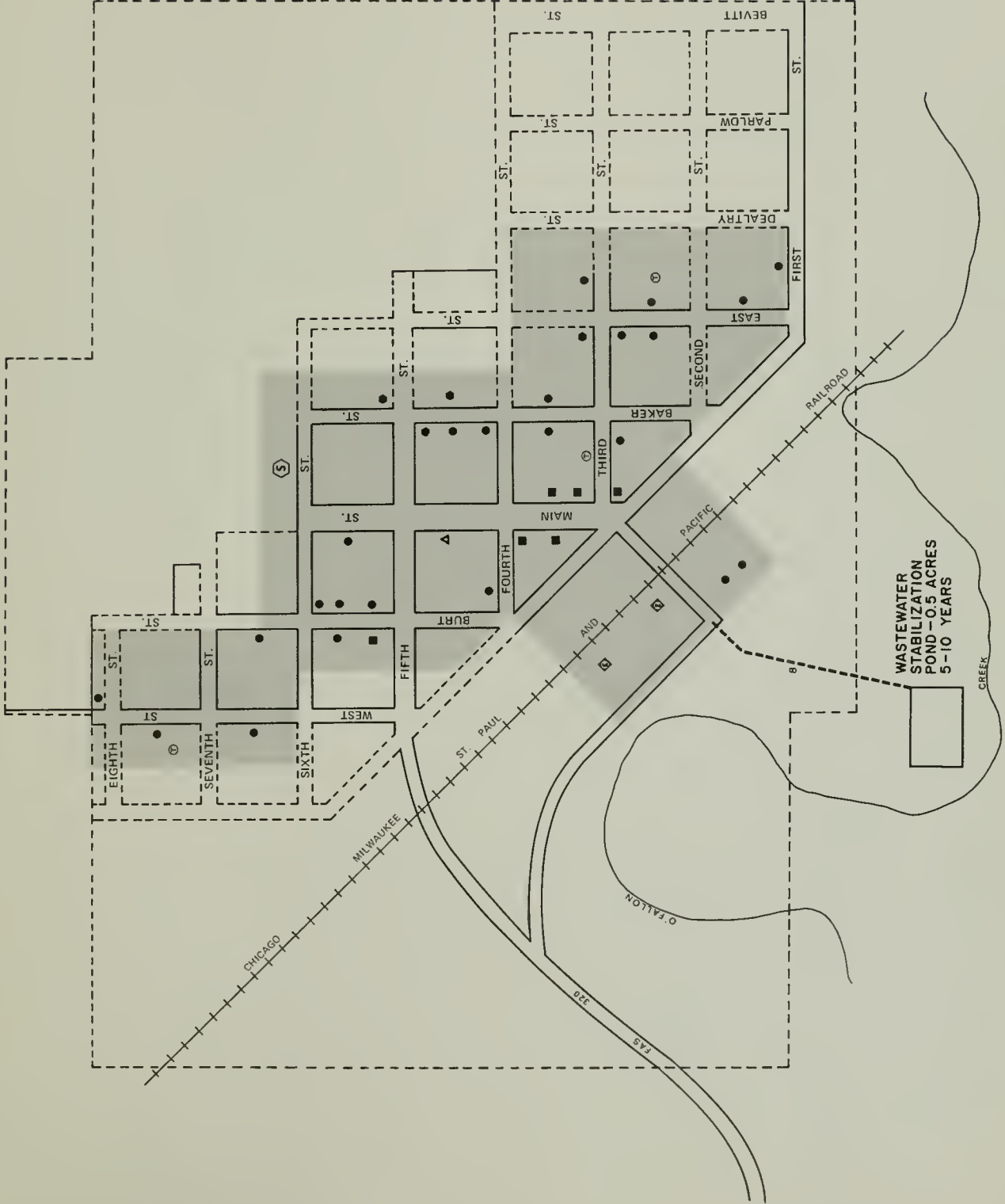






ISMAY SEWER SYSTEM

SCALE 1" = 100'
0 100 200 300 400
MAP 7



POWDER RIVER COUNTY

MONTANA

POWDER RIVER COUNTY

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CONCLUSIONS, RECOMMENDATIONS, AND PRIORITIES

Conclusions

The total population of Powder River County is expected to decrease during the planning period; each of the communities within the county will show a decrease during this period of time.

The existing water and sewer systems in Broadus and Bell Creek are generally in good condition. Improvements or additions to these existing systems are proposed where necessary. It is proposed that the South and West Environs of Broadus be served by expansion of the existing Broadus systems. Although it is not immediately necessary that the community of Biddle be served by central water and sewer systems, the possibility of providing these systems is discussed.

Recommendations

This plan shows the various types of improvements which the communities should be considering during the planning period. Elaborate systems are not proposed but rather those facilities necessary to provide safe and adequate community systems. It is recommended that this general plan be adopted by the governing agencies of each community. A detailed approach, which must be undertaken to insure completion of the improvements in each community, cannot be covered in a report of this type. Community leaders, however, do have several courses of action which may be taken.

Most small communities do not have the means to plan and finance complete water and sewer systems. Therefore, to enable communities to acquire such facilities, five departments of the Federal Government have legislation authorizing loans or grants for construction of public works. These agencies are:

Farmers Home Administration
United States Department of Agriculture
P.O. Box 850
Bozeman, Montana 59715

Federal Water Quality Administration
United States Department of the Interior
% Montana State Department of Health
Helena, Montana 59601

Public Health Service
United States Department of Health, Education, and Welfare
Division of Indian Health
Billings, Montana 59101

Administration for Metropolitan Development
United States Department of Housing and Urban Development
Assistant Regional Administrator
Denver Regional Office
1050 South Broadway
Denver, Colorado 80209

Economic Development Administration
United States Department of Commerce
Montana Field Coordinator
207 Medical Arts Building
Butte, Montana 59701

The legislation is constantly changing; therefore, community leaders should investigate the various alternatives and determine which program and course of action would be most beneficial to them.

Priorities

That a particular system requires immediate improvements and another system will be satisfactory for a definite period are difficult to establish. Several indicators for establishing priorities are available, however. The general health of the people is the prime consideration, and this can only be insured when safe water supplies are provided. Water supply in adequate quantities is another important factor. Waste water must be treated and disposed of by safe methods to minimize the problems of pollution and to protect public health. The total number of persons benefited by any improvement must also be considered. These basic criteria were used in establishing the following priority listing:

1. Broadus Sewer System. The number of persons who would benefit from the expansion of the existing Broadus system to serve the South and West Environs of Broadus makes this project of top priority. Also, elimination of potential hazard and contamination problems makes the project necessary.

2. Bell Creek Sewer System. The potential health hazard created by the inadequacy of the present wastewater treatment facility makes planning and construction of this project of immediate importance.

3. Biddle Sewer System. The local demand has not developed to the point where construction of this facility is required; however, the size of the community and the potential health hazard are reasons to warrant planning and construction of this project.

4. Broadus Water System. The proposed addition of storage and supply for the Broadus system in order that the South and West Environs of Broadus may be included within the service area will benefit a substantial number of persons. Following the construction of a central sewer system or the advent of well contamination problems, planning for construction of this project should begin.

5. Biddle Water System. This facility is not immediately needed; however, it could be quite easily constructed. As sufficient demand develops, the planning for this facility should begin.

This list of priorities is not intended to govern the order in which action should be taken. The order merely ranks the severity of the problems and the need for improvements.

THE LAND

General Characteristics

Powder River County is located in the southeast portion of the State of Montana, and it is bounded on the north by Custer County, on the east by Carter County, on the west by Rosebud and Big Horn Counties, and by the State of Wyoming on the south. The total area encompasses 3,298 square miles of which thirteen square miles consist of water surface. The major water areas include the Little Powder River, Powder River, Mizpah River, and Pumpkin Creek, all of which flow north and finally empty into the Yellowstone River.

The topography on Map 1 indicates a variety of land types in the county. The western portions are characterized by the rough, hilly areas with occasional high peaks of the Custer National Forest, and the eastern part of the county tends to have gentle slopes interspersed with small coulees and breaks. Elevations vary from a low of 2,850 feet above sea level to a high of 4,455 feet in the extreme southeast corner of the county. The lower areas are generally found in the broad valley surrounding the Powder River.

The county is well served by highways and roads with the town of Broadus serving as the main hub. U. S. Highway 212 enters the northwest part of the county and runs diagonally to Boyes in the southeast corner where it continues into Carter County. State Highway 59

extends into the county from Wyoming to the south and terminates within the county at Broadus. U. S. Highway 312 originates northwest of Broadus and continues northerly for seventy nine miles terminating at Miles City. A system of improved gravel and unsurfaced roads serves the remainder of the county. This transportation system plays an especially important economic role because of the absence of rail service in the county.

There are no commercial airports in Powder River County; however, a 3,100 foot, lighted, unpaved landing strip is located in Broadus where minimum services are available. Two other public use landing fields are also located in the county. One is a 2,800 foot, unpaved strip located at Stevens, and the other, located at Janssen, is a 3,200 foot strip also unpaved. There is a 2,100 foot strip at Washington which is not built to normal dimensional standards and requires special techniques and procedures to use, and this strip is not intended for full public access. Daily air service and connections to nation wide airlines are available at either Billings, Glendive, or at Rapid City, South Dakota.

Electrical power is supplied by the Tongue River Electric Cooperative located in Ashland, Montana. Broadus serves as a hub of the power system and is connected to Ashland by a sixty nine kilovolt line. Major lines run to Coalwood and Powderville in the north and to Biddle and Moorhead in the south. The western part of the county is served from the line between Ashland and Broadus. Power is supplied to the Tongue River Electric Cooperative by the United States Bureau of Reclamation and the Montana Power Company.

Since major power producing centers and relay stations are usually located at widely separated points and provide power service to large areas, Map 2 shows the major power grid system for the entire State of Montana. Major gas transmission lines are also shown.

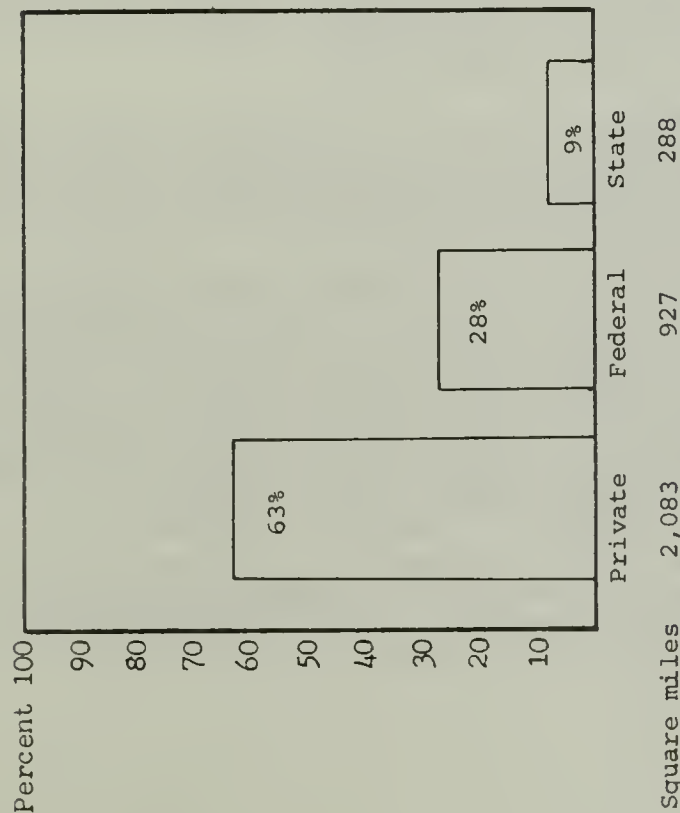
Telephone service is provided by two separate companies. The largest area, which includes everything except a service area out of Broadus, is served by the Range Telephone Cooperative. The area surrounding Broadus and extending along the Powder River is served by Mountain States Telephone.

Land Ownership and Use

As seen in Chart 1, there are three ownership categories in the county. Private is the largest and accounts for sixty three percent of the total. Land under federal ownership represents twenty eight percent, and the state claims the remaining nine percent.

CHART 1

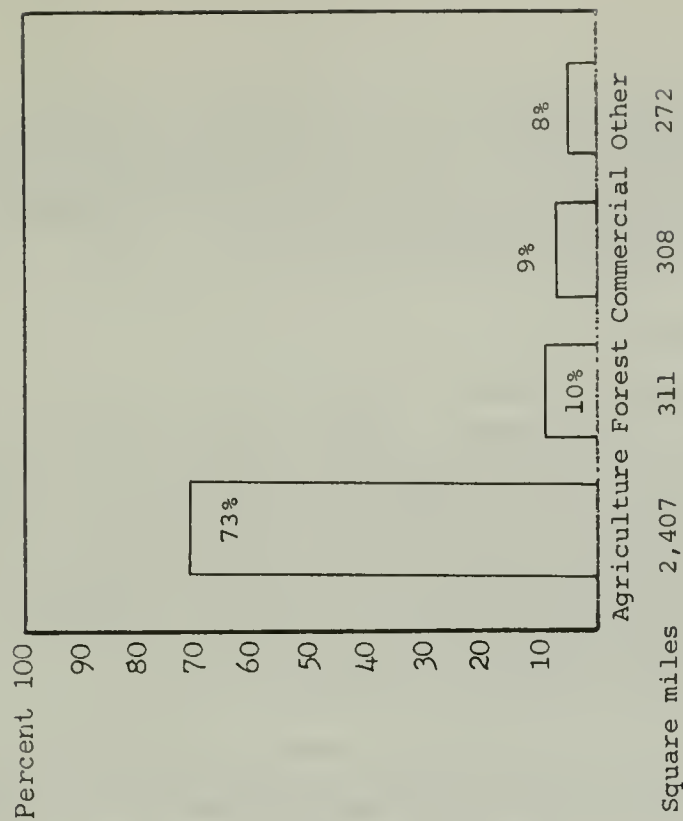
Land Ownership
Powder River County



- Sources: 1. The Montana Almanac, 1959-60
 2. Forest Service, U. S. Department of Agriculture
 3. U. S. Census of Agriculture, 1964

CHART 2

Land Use
Powder River County



The land use pattern generally reflects the physical characteristics of the county. Almost three fourths of the land is used for agriculture. The Custer National Forest accounts for ten percent of the land and commercial use for an additional nine percent. The remaining eight percent consists of water surface area, land in transportation routes, and other uses not included above.

Natural Resources

Petroleum, gas, sand and gravel, stone, and coal are the important natural resources of the county. Petroleum activities are located in the Bell Creek Field in the southeastern part of the county. In 1968 there were 402 new wells drilled of which only 172 were dry. In that year there were 328 producing wells on record which produced three hundred barrels each per day. The field is one of the major petroleum finds in Montana. The Bell Creek Field also produced 586,214 Mcf (thousand cubic feet) of gas in 1968. Natural gas also exists in the Pumpkin Creek area in the northern part of the county but is not being extracted at this time.

The Birney-Broadus and Moorhead coal fields lie predominately in Powder River County. These fields contain many thick continuous coal beds mostly of sub-bituminous rank coal with some lignite. The concentration of coal is greater than in any other part of Montana and, according to United States Department of Interior figures, contains 19.5 percent of the total coal reserves for the state. This includes 40,984 million short tons of sub-bituminous coal and 2,434 million short tons of lignite coal.

The demand for sand, gravel, and stone stems from highway and railroad needs. The amount of the resource produced depends on building activities in the area, and because other counties also produce the resource the export demand is limited.

Recreational opportunities in the county include renowned antelope hunting. Whitetail and mule deer are found in the wooded hills and river breaks which are also the habitat of upland game birds including wild turkeys. The Powder River, Little Powder River, Pumpkin Creek, and other smaller streams provide excellent fishing for several varieties of game fish. A large portion of the county area is covered by the hilly woodlands of the Custer National Forest and provides for such varied outdoor activities as camping and hiking.

Further development of the opportunities for recreation existing in the county will further enhance the role that industry plays in the local economy.

Soils

Soils in the county are generally of two main types. The first is the range grass and field crop supporting type which lends toward the encouragement of agricultural activities. The second is the forest soils type. Soils in this category are generally located in the Custer National Forest at the higher elevations.

Soils data is covered in detail later in this report.

Water

The Powder River constitutes the major drainage in the county. The river extends from Wyoming and enters Montana just south of Moorhead. It travels northeasterly through Broadus and near Powderville before leaving the county. The Little Powder River also flows from Wyoming, and it enters the county south of Biddle then drains into the Powder River north of Broadus. The Mizpah River, originating near Sonnette, also empties into the Powder River in Custer County. Pumpkin Creek heads near Sonnette and flows north, draining into the Tongue River south of Miles City.

Both surface and ground-water resources are covered in detail later in this report.

THE PEOPLE

Population

For analytical and projective purposes, it is necessary to study the population history of Powder River County to find out what has happened and what is expected in the future. Chart 3 graphically shows the growth of the county as compared with that for Montana and indicates the future growth for both.

Population in the county during the past fifty years has followed a fluctuating pattern generally on the down side. The estimated 1970 population is about eighty three percent of the 1920 figure as a result of the up and down cycles. Substantial growth occurred during the 1920's and the 1960's. The forecasted 1990 population will be two thousand, or not quite two thirds of the 1920 number.

In 1960 the county was classified as a rural area containing no urban areas and being located neither in nor near a major aggregate of urban population. Table 1 indicates that growth is occurring in the urban

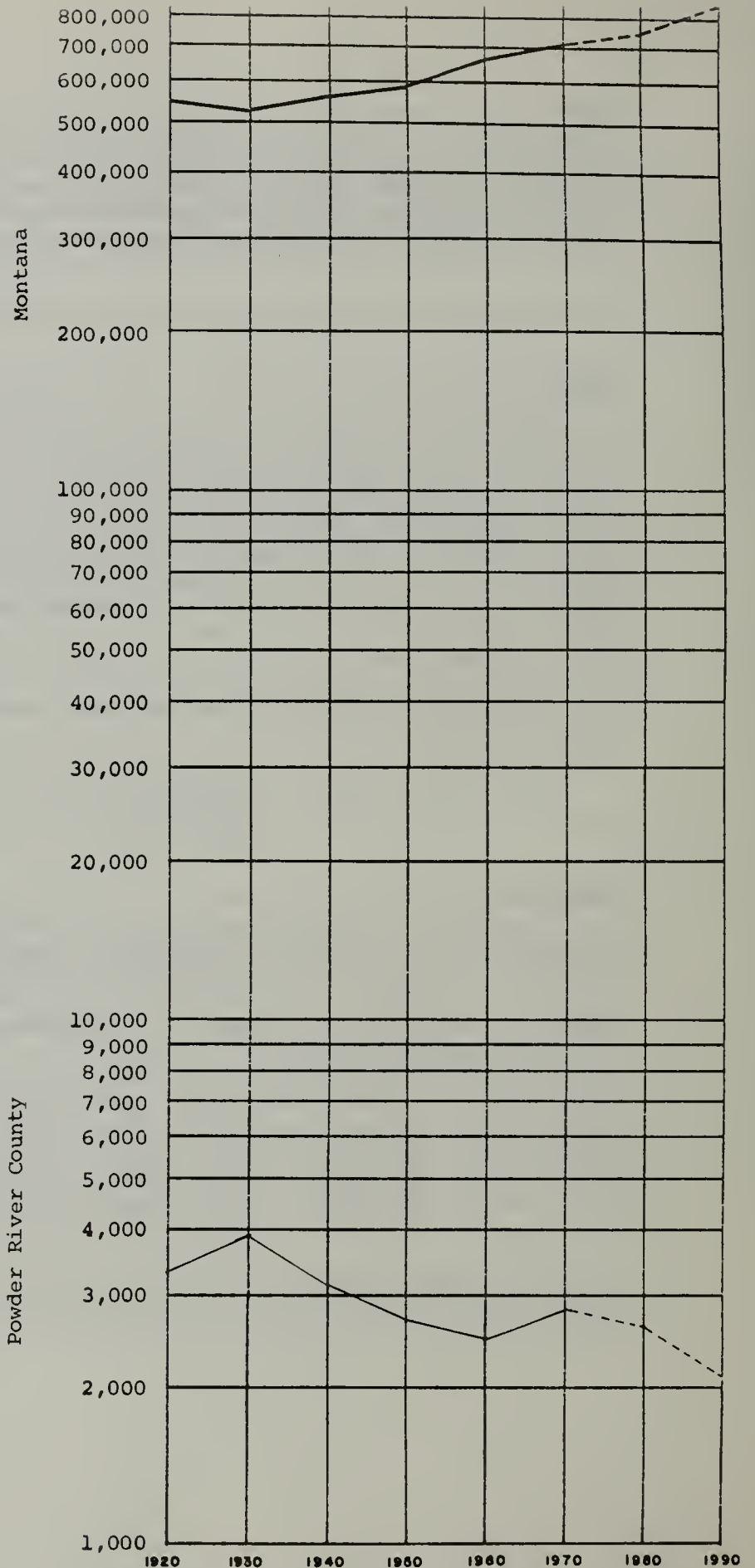
CHART 3

COMPARATIVE POPULATION TRENDS

Powder River County
and Montana

Sources:

1. U.S. Census of
Population
2. Intermountain
Planners, Inc.



population but not in the rural counterpart. The majority of the rural losses are among the farm population while growth is noted in the rural non farm segment. From 1960 to 1970 this category increased by 408 percent while the farm population decreased by almost one third. Over the twenty year reporting period the urban population has continued to grow at a faster pace than the other groups. In 1950, for example, this category represented one fifth of all the people. The ratio increased to one fourth in 1960 to a present figure somewhat higher than one third. At the beginning of the same period the farm group accounted for seventy percent of the total. The ratio dropped to sixty three percent in 1960 and to thirty nine percent today. The rural non farm population rose from eleven percent in 1950 to a present twenty five percent.

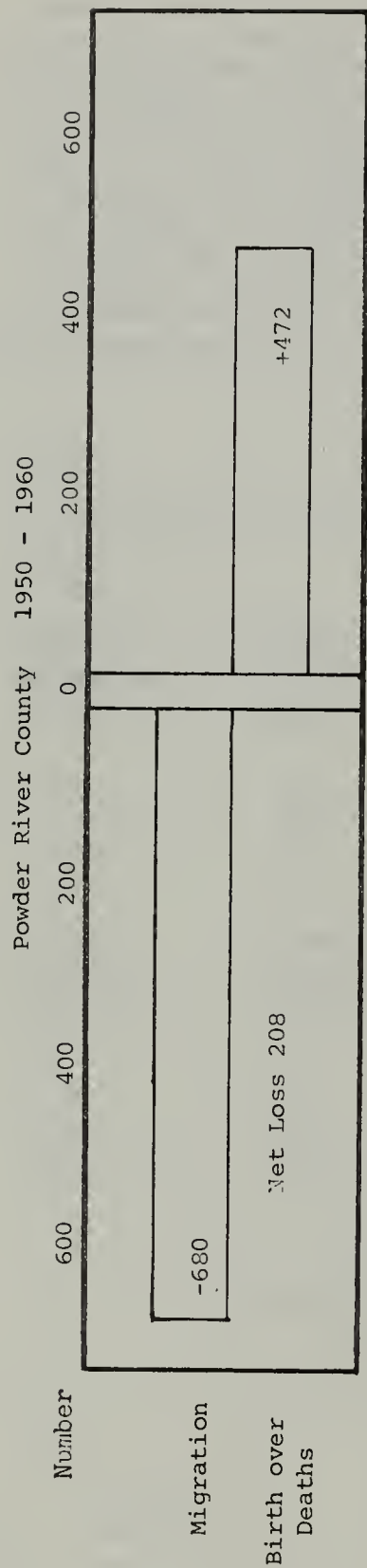
TABLE 1

Urban-Rural Population Changes for Powder River County
1950-1970

	<u>1950</u>	<u>1960</u>	<u>Changes</u> <u>Number</u>	<u>1950-1960</u> <u>Percent</u>
Total	2,693	2,485	-208	- 7.7
Urban				
(Inc. Towns)	517	628	+111	+21.5
Rural	2,176	1,857	-319	-14.7
Farm	1,883	1,565	-318	-16.9
Non Farm	293	292	- 1	- 0.3
	<u>1960</u>	<u>1970</u>	<u>Changes</u> <u>Number</u>	<u>1960-1970</u> <u>Percent</u>
Total	2,485	2,800	+315	+ 12.7
Urban				
(Inc. Towns)	628	1,000	+372	+ 59.2
Rural	1,857	1,800	- 57	- 3.1
Farm	1,565	1,100	-465	- 29.7
Non Farm	292	700	+408	+139.7

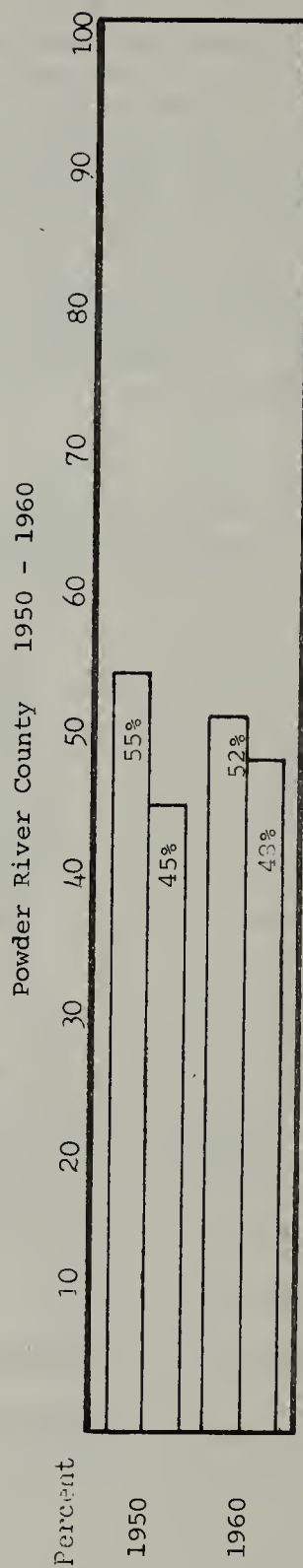
Sources: 1. U. S. Census of Population, 1950-1960
2. Intermountain Planners, Inc.

CHART 4
Population Change



Source: Net Migration of Population, 1950-1960 by Age, Sex, and Color,
U. S. Department of Agriculture

CHART 5
Population by Sex



Source: U. S. Census of Population, 1950-1960

During the period from 1950 to 1960 the county experienced a population loss of 208 persons. The decline in total numbers resulted from a net migration loss of 680 persons and an excess of 472 births over deaths.

The change in sex composition from 1950 to 1960 is shown in Chart 5. During this period the preponderance of males dropped from fifty five percent in 1950 to fifty two percent in 1960. The ratio should not change significantly throughout the planning period.

The age distributions by sex for 1950 and 1960 are shown in Table 2. Growth in numbers occurred in the younger and the older age groups.

TABLE 2
Age & Sex Composition of Powder River County

Age Group	<u>1950</u>		<u>1960</u>	
	Male	Female	Male	Female
Under 5	189	152	141	154
5-14	237	224	296	278
15-19	90	96	89	76
20-24	128	103	52	62
25-34	229	164	164	168
35-44	170	161	180	143
45-54	158	130	125	114
55-64	153	99	114	88
65-74	96	51	95	70
75 +	36	27	43	33
Total	1,486	1,207	1,299	1,186

Source: U. S. Census of Population, 1950-1960

A total of three towns and communities were studied in Powder River County. The list includes the incorporated town of Broadus and the two unincorporated communities of Biddle and Bell Creek. The communities of Coalwood, Epsie, Olive, Otter, and Powderville were also studied but were not included in this report because of insufficient population and development.

Because of the amount of time that has elapsed since the 1960 Census, current population estimates had to be derived from several sources in the field. Surveys and interviews were conducted to determine what now exists and what is expected in the future. Table 3 indicates the past population experience and the future projections for each town and community.

TABLE 3

Population Forecast for Towns and Communities

Powder River County

	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1990</u>
Biddle	12	25	125	125	100	60
Broadus	517	628	1,000	950	900	750
South Environs	NA	NA	50	55	50	40
West Environs	NA	NA	210	200	190	175
Bell Creek	NA	NA	325	350	325	200

Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

The number of persons in Broadus has increased since 1950, and it now has an estimated population of one thousand. The projected population in and around the town is expected to decline over the next twenty years.

The populations of Biddle and Bell Creek have also increased over the past years. Similar to Broadus, their numbers are also expected to decrease by 1990 because of greater efficiencies and consolidation in the agriculture and oil industries.

The population figures reflect only those factors and trends for which information is available. New technological advances, new industries, or other unforeseen events may alter these projections. If such an event occurs, the areas affected should be studied in light of the new conditions.

Housing

In 1960 there were 850 housing units in Powder River County. Chart 6 indicates that forty six percent of the housing units were of the rural non farm type with the remainder represented by farms. Since the county lacked any recognizable urban centers in 1960, there was no urban classification of housing units as found elsewhere in Montana. The median housing unit size was 4.1 rooms per unit, and the median household size per occupied unit was 3.4 persons. Almost two thirds of all units were owner occupied and one fifth were used for rental purposes. Chart 7 indicates that fifteen percent were vacant. The 1960 condition of housing is reflected in Chart 8. Only nine percent of all housing units were in need of replacement while twenty two percent needed repair. The remainder were classified as sound.

Chart 9 reflects the 1960 status of housing units in terms of source of water, water supply, and method of sewage disposal. For geographical reference, the data shows the status for Powder River County as a whole and for rural non farm and the farm homes.

HOUSING Powder River County 1960

Chart 6
Housing Classification

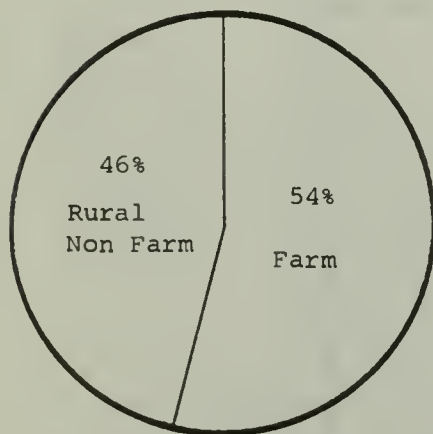


Chart 7
Housing Tenure

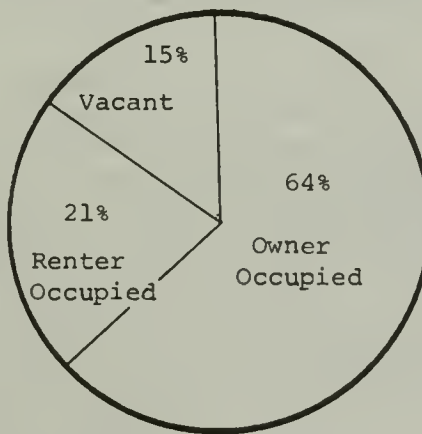
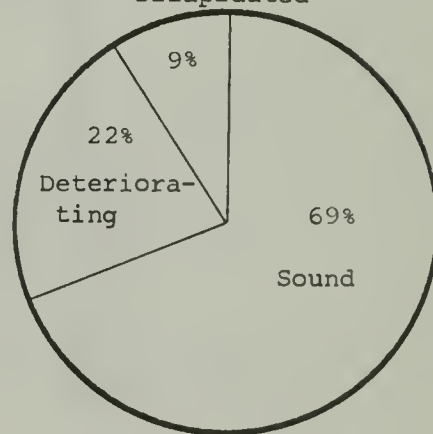
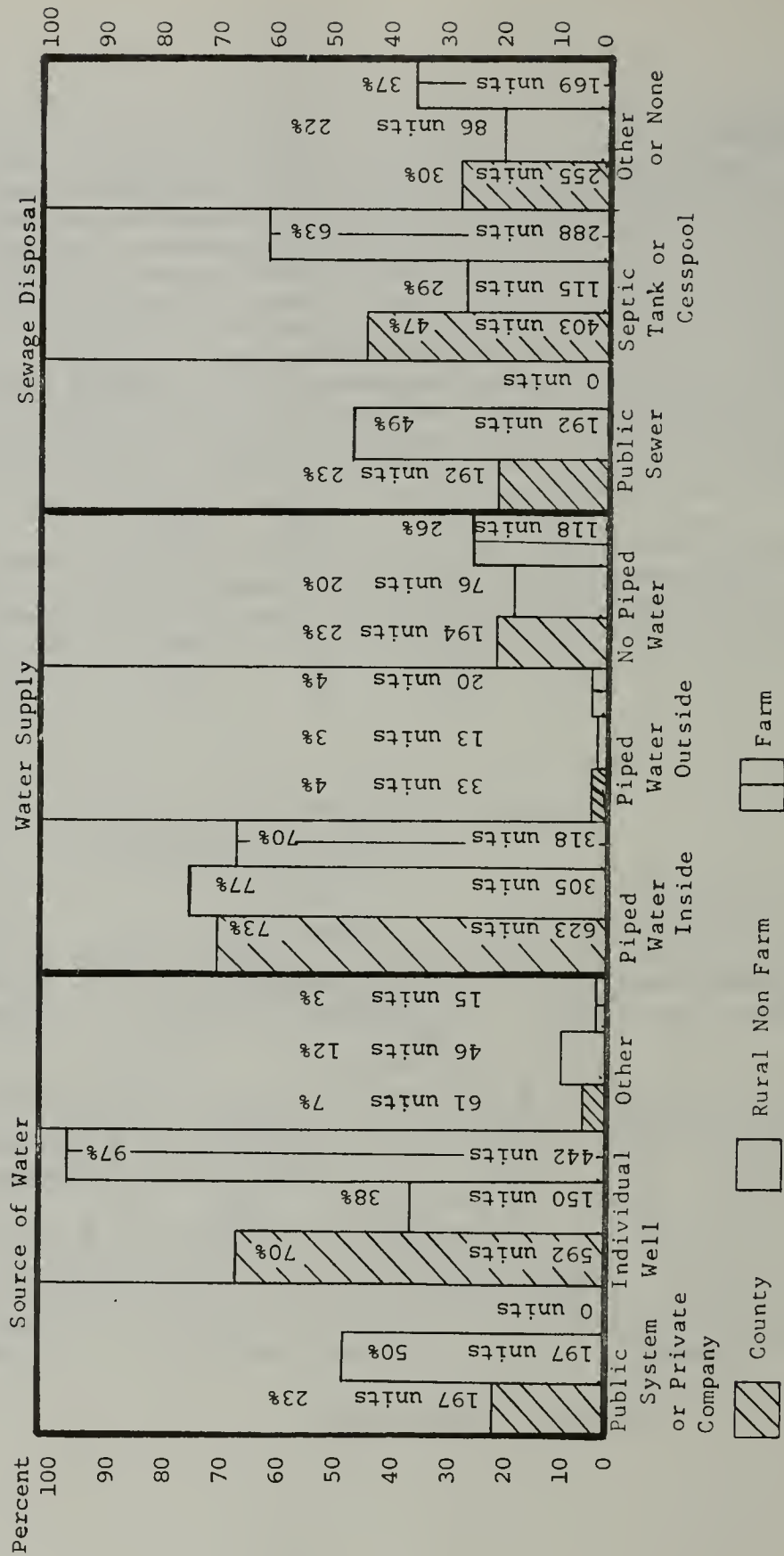


Chart 8
Housing Condition
Dilapidated



Source: U. S. Census of Housing, 1960

CHART 9
Sewer and Water
Powder River County 1960



Source: U. S. Census of Housing, 1960

Less than one fourth of all homes were served by a public water system or by a private company in 1960. Those served included half of the rural non farm homes and none of the farms. The majority of homes relied on individual wells for water. This group included thirty eight percent of the rural non farm homes and almost all the farms. Only one home in fourteen relied on another water source.

Almost one fourth of the homes did not have piped water. The list included one fifth of all rural non farm homes and twenty six percent of the farms.

A similar number of homes as those being served by a water system utilized a public sewer system for waste disposal. Half of the homes relied on either septic tanks or cesspools for disposal. This figure included twenty nine percent of the rural non farm homes and almost two thirds of the farms. One third of all dwelling units used still another method for disposing of sewage. This figure included twenty two percent of the homes in the non farm areas and over one third of all farms.

The above data indicates that a deficiency existed in 1960 in terms of public facilities. The rural non farm areas in the county, which includes all urban development, were particularly lacking in adequate water and sewer systems.

THE ECONOMY

Labor

The economy of Powder River County is dependent on the people because of their role as both producers and consumers of goods and services. The following economic analysis is concerned primarily with the total economic spectrum and how it may affect the future of the area. Changing economic conditions can have either a good or a bad effect in terms of population growth, ability to provide for public improvements, or in determining the general overall living environment.

Employment in the county declined by a fifth between 1950 and 1960, a rate slower than the eight percent population loss. The reduction in the labor force is contrasted with a six percent rise in the State of Montana for the same period.

Past employment changes by major industry groups is shown in Chart 10. Between 1950 and 1960 population in the county contracted moderately while unemployment declined to the lowest relative level

in southeastern Montana. The one fifth drop in employment and labor force was shared by both males and females. The county recorded the third highest percentage loss in labor force and employment in the state. There were no unemployed females in 1960. Agriculture accounted for eighty percent of the job losses with manufacturing and construction providing fourteen percent. Services and finance accounted for about one half of the minor employment gains.

The labor scene strongly indicates an agriculturally based economy. The agriculture group attracted well over half of all labor in 1960 in spite of a one third reduction in size. The county lies within the Miles City and the Belle Fourche, South Dakota farm output marketing center, thus enhancing its sale of products.

Persons in the county strongly rely on Miles City for providing most of their needs. Minimum convenience outlets are available in Broadus, but they do not offer the full selection of goods and services as located in Miles City.

The dependency of the county on other areas for goods and services is seen by the employment characteristics of the trade and the services and finance industry groups. Over half of the latter group is comprised of school teachers while only eleven percent are represented by the finance, insurance, and real estate industry. There was a total absence of business services in the county. One half of the trade group was represented by grocery store, bar, and restaurant employees.

Percentages for employment by industry group in Table 4 provide an insight into local employment characteristics. The table shows the relative weight of each group and offers a comparison with that existing in 1960 for the State of Montana and the United States.

Agriculture clearly provided the most job opportunities in the county. The employment level of this industry group was almost four times that of the state and six times larger than for the nation.

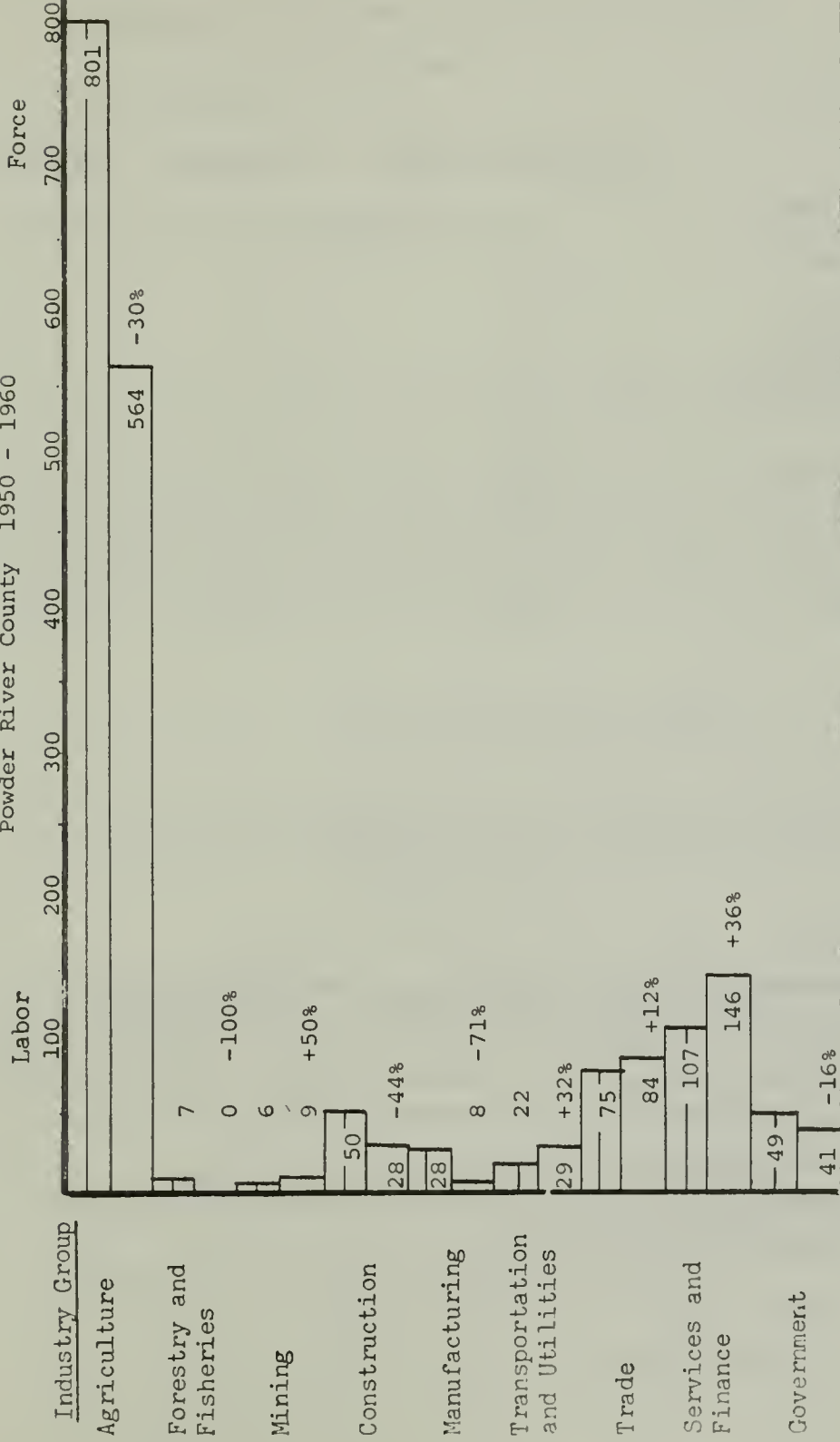
Because of the one industry economic base, the remaining industries were at levels generally lower than those in Montana and the United States.

Recent oil activities in the county have generally raised employment levels in some groups. Labor statistics provided by the Employment Security Commission of Montana indicate that in 1969 mining employment, which includes mineral fuel extraction, rose to 160 employees as compared to the nine recorded in 1960. Since the oil is piped to Gillette, Wyoming, some growth which normally accompanies oil drilling did not occur in the county.

CHART 10

Employment Change by Major Industry Group

Powder River County 1950 - 1960



1950 Total Employment 1,160*

1960 Total Employment 913*

*Includes Some Industries Not Reported

Source: U. S. Census of Population, 1950-1960

TABLE 4

Percent of Total Employment by Industry Groups

Powder River County, Montana and United States

1960

	<u>Powder River County</u>	<u>Montana</u>	<u>United States</u>
Agriculture	62	17	11
Forestry and			
Fisheries	0	1	1
Mining	1	3	1
Construction	3	7	5
Manufacturing	1	10	27
Transportation			
and Utilities	3	9	7
Trade	9	21	19
Service and			
Finance	16	26	16
Government	5	6	13
	—	—	—
Total	100	100	100

Source: U. S. Census of Population, 1960

The county will probably continue its present economic mix. Any growth will be moderate at its highest level.

Agriculture

The United States Census defines a farm as a place having at least ten acres of land devoted to agriculture and selling at least fifty dollars worth of agricultural products annually. According to Chart 11, there were 340 farms in Powder River County in the above category in 1964, ten percent fewer than existed in 1959.

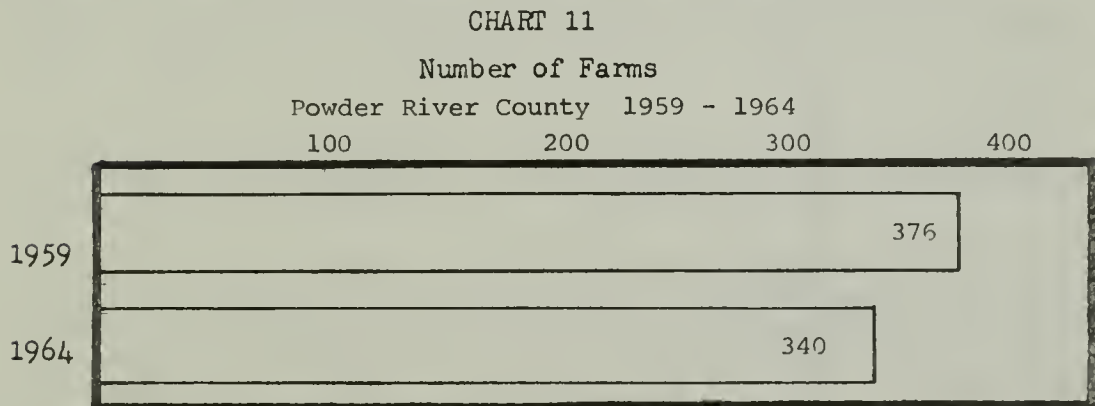
The 1964 classification of farms by type was as follows:

Field crop farms other than vegetables, nuts, and fruit	21
Cash grain	20
Other field crops	1

Dairy farms	
Livestock farms other than poultry and dairy	283
General farms	9
Miscellaneous and unclassified	26
Total	340

Of the total number of farms, fourteen were classified as part time, and eleven were classified as being operated by semi retired persons.

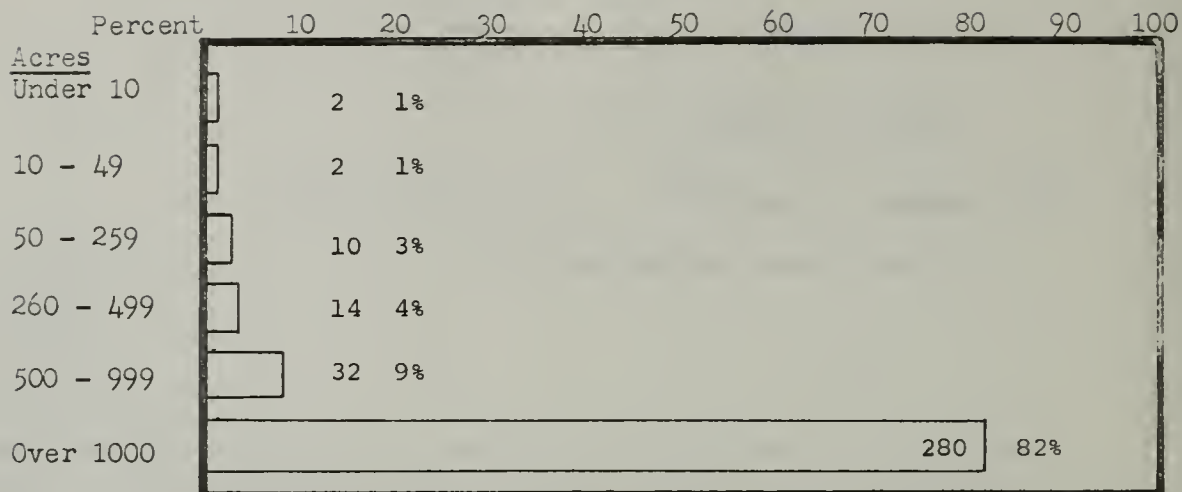
The above data clearly shows the preponderance of livestock production in the agricultural economy. Eighty percent of the farms were livestock producers as opposed to only six percent as crop raisers. In 1964 the average farm was 4,530 acres in size. Chart 12 indicates that eighty two percent of all farms were over one thousand acres.



Source: U. S. Census of Agriculture, 1964

CHART 12

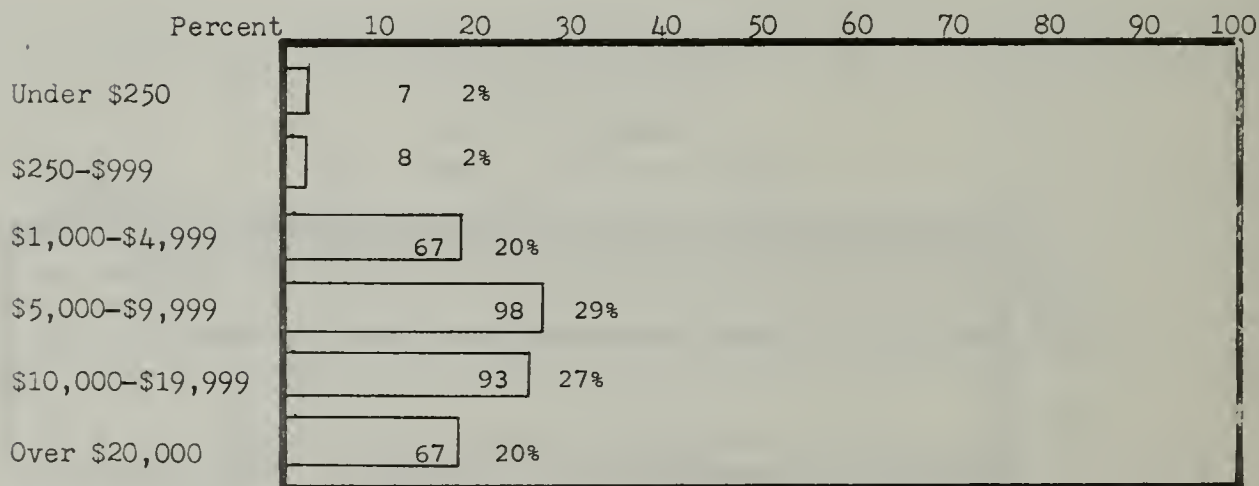
Farms by Size
Powder River County 1964



Source: U. S. Census of Agriculture, 1964

CHART 13

Number of Farms by Value of Farm Products Sold
Powder River County 1964



Source: U. S. Census of Agriculture, 1964

At the same time less than ten percent of the farms were under five hundred acres.

The value of products sold by the number of farms is shown in Chart 13. As indicated, almost half of the farms reported gross sales exceeding \$10,000 while one fifth received more than \$20,000 for agricultural products sold. One fourth of all farms reported gross receipts less than \$5,000.

Cash receipts data from 1964 to 1967 is as shown:

<u>Year</u>	<u>Livestock</u>	<u>Crops</u>	<u>Total</u>
1964	\$4,572,000	\$1,123,100	\$5,695,000
1965	\$5,403,600	\$ 914,100	\$6,317,700
1966	\$6,633,900	\$1,123,900	\$7,757,800
1967	\$5,733,900	\$1,366,800	\$7,100,700

During the four year reporting period the sale of livestock products accounted for more than four of every five dollars received for agricultural products sold. The preponderance is expected to continue throughout the planning period.

THE GOVERNMENT

Before any meaningful consideration can be given to major capital improvement projects, it is necessary to study the governmental organizations in Powder River County and to analyze their economic structure. At present there are two separate, local governmental units in the county involved within the scope of the water and sewer study. Included are the incorporated city of Broadus and the government of Powder River County.

A Board of County Commissioners presided over by a chairman governs the county. The incorporated municipalities are governed by a mayor council form of government.

In financing capital improvement projects, the incorporated municipalities have power to bond and raise the necessary monies for funding projects. The unincorporated small towns do not have similar power and, therefore, must rely on financing projects through the county government.

Table 5 indicates the financial condition of each unit of government in 1969.

TABLE 5

Financial Status of County Government and Incorporated Cities

Powder River County 1969*

	<u>Revenue</u>	<u>Expenditures</u>	<u>Assessed Valuation</u>
Powder River County	\$1,151,584.20	\$1,268,199.90	\$24,105,894.00
Broadus	74,662.76	110,958.11	2,613,776.00

* There are several methods presently available to communities for financing water and sewer systems:

1. Incorporated Cities and Towns may use Municipal Bonds, Municipal Revenue Bonds, and Special Improvement District Bonds.
2. Unincorporated Towns may use Rural Special Improvement District Bonds and County Water and Sewer District Bonds.
3. Incorporated Cities and Towns and adjacent unincorporated areas may use Metropolitan Sewer District Bonds.

Source: Information received from each governmental unit

THE WATER RESOURCES

General

The water resources of any area are one of its most important assets. Montana is fortunate in that water is in abundant supply over much of the state. This is especially true in the mountain areas and along the major drainages. Water is essential for many human needs with individual consumption and sanitation being foremost. Industrial and agricultural uses of water are perhaps next most important. The recreational use of water has also become a significant factor in modern day living.

In his use of this resource, man in the past has polluted much of the available fresh water and degraded it to the point where it is unfit for many or all uses. Careful planning for the efficient use of water resources can avert inconveniences caused by pollution.

Water resources, therefore, are an important consideration in the comprehensive planning for community water and sewer systems. In the following portion of this report the existing water resources of the planning area will be briefly reviewed. The discussion will be specifically concerned with the occurrence and availability of both surface and ground water. Also important, and included in Appendix I, are the specific laws and policies of the State of Montana concerning surface and ground-water resources. "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" adopted by the State Department of Health are discussed in detail. Table A in Appendix I outlines present day water quality standards as set forth by the United States Health Service.

Surface-Water Resources

Powder River County has an extensive drainage system which has primary characteristics of plains and foothill topography. Drainage may be found flowing in almost any direction; however, the main drainage pattern is to the northeast.

Elevation differences are not excessive, and the complex surface drainage is attributed to the extremely hilly topography. In general, the highest elevations, over four thousand feet, occur in the hills of the Custer National Forest in northwestern Powder River County. The lowest elevation, less than three thousand feet, occurs where the Powder River leaves the county near Powderville.

The major drainage features of the county are the Powder River and the Little Powder River. The Powder River heads in Wyoming and flows into Powder River County near Moorhead. The river flows northeast across the county before entering Custer County northeast of Broadus. The Little Powder River also heads in Wyoming and flows into Powder River County south of Biddle. The Little Powder River flows north to its confluence with the Powder River just northeast of Broadus. Other drainages such as Otter Creek and Pumpkin Creek in western and northwestern Powder River County provide drainage for that area. Otter Creek and Pumpkin Creek are tributaries of the Tongue River. The remainder of the drainage from Powder River County is received by the Powder River and its tributaries and all of the drainage from Powder River County eventually flows north to the Yellowstone River.

The above mentioned streams provide a yearlong source of water for

irrigation, livestock, and domestic needs. Many of these streams have gaging stations installed by the United States Geological Survey (U. S. G. S.) where flow measurements are taken and recorded at regular intervals. Table 6 includes available data on the drainage area, discharge, and runoff for each gaging station pertinent to Powder River County.

Many small reservoirs add significantly to the agricultural and especially the irrigational use of water in the county. As is the case in most counties in Montana, there are no records for small reservoirs published by the U. S. G. S. The Montana Water Resources Board, however, has compiled and published a list of reservoirs which store fifty acre feet or more of water. Where information was available, data for privately owned dams and reservoirs was also included. Information on irrigation facilities in Powder River County can be obtained from the Water Resources Board in Helena, Montana. A publication entitled "Water Resources Survey" for Powder River County, Montana was published by the Water Resources Board in June, 1961. This publication contains a complete history of land and water use on irrigated areas and includes maps showing irrigated areas and designating sources of supply. This information should be consulted for detailed data on surface water appropriation and use in Powder River County.

The climate does not have the extreme variable pattern common to the more mountainous western counties of Montana. Precipitation averages vary across the county; however, with the highest averages being recorded along the higher elevations of western Powder River County. For instance, records indicate that annual precipitation averages between seventeen and twenty inches occur at the higher elevations in the hills of the Custer National Forest. In central and eastern Powder River County, on the other hand, annual averages at Broadus for a twenty three year period were 14.01 inches. Other averages include 13.87 inches at Boyes, 11.68 at Moorhead, 12.09 inches at Powderville, and 10.70 inches at Biddle. It is important to note, however, that the majority (approximately seventy five percent) of the annual precipitation falls during the growing season of April through September.

In general, precipitation occurs as heavy rain in the spring months of April through June, intermittent showers throughout the summer and early fall months, and as snowfall during the winter months. The snowfall is generally light in the lower elevations of the county; however, annual snowfall at the higher elevations has been estimated to be as much as one hundred inches in sections. Snow does not tend to remain on the ground for long periods of time at the lower elevations, and winter warming spells producing thawing temperatures are not uncommon.

TABLE 6

Stream Gaging Stations

Stream	Gaging Sta. Location	Drainage Area (sq mi)	Miles to Nearest City	Discharge (cfs)				Years Averaged	Runoff-(1000 Acre-Ft)		
				Max.	Date	Min.	Date		Max.	Date	Min. Date
1. Powder River	At Moorhead	8,088	1,2	23,000	6/17/62	No Flow	At Times	39	634.5	1944	135.1 1954
2. Little Powder River	At Biddle	1,540	1,3	5,700	8/17/40	No Flow	At Times	*	21.9	1939	14.6 1942
3. Little Powder River	Near Broadus	1,974	1	2,340	6/15/53	No Flow	At Times	16	46.6	1949	10.2 1958
4. Powder River	Near Locate in Custer County	13,194	1	31,000	2/19/43	No Flow	At Times	30	1,184	1944	246.6 1956

Source: U. S. Geological Survey Water Supply Papers and
"Surface Water Records of Montana"

Notes: 1. Irrigation diversions occur above these stations

2. Flow is regulated by one or more reservoirs

3. Only short term or seasonal records available

* Not Recorded

The use of surface water is widespread for agricultural and recreational purposes. The irrigation summary of Powder River County included in the "Water Resources Survey" published by the Water Resources Board in 1961 indicates that at that time 33,186 acres were being irrigated in Powder River County. As is the case in most counties in eastern Montana, the potential exists for the irrigation of many additional acres. Also important is the use of surface water for recreational purposes. The ponds, reservoirs, and streams in the county are ideal habitat for fish and waterfowl and draw many sportsmen to the area each year.

Water Use Classifications

The Water Pollution Control Council has classified the streams and drainages in Montana according to the water use classification definitions shown in Appendix I. The streams and drainages of Powder River County and surrounding areas are classified as follows:

Yellowstone River drainage from the Billings water supply intake to the North Dakota line except the tributaries listed below:	B-D ₃
Pryor Creek drainage	B-D ₁
Big Horn drainage above but excluding William's Coulee near Hardin	B-D ₁
Big Horn drainage from and including William's Coulee to the Yellowstone River except the Little Big Horn listed below:	B-D ₂
Little Big Horn drainage above and including Lodge Grass Creek near Lodge Grass	B-D ₁
Remainder of the Little Big Horn drainage	B-D ₂
Tongue River (mainstem) from Tongue River Reservoir to but excluding Prairie Dog Coulee	B-D ₂
Fox Creek drainage near Sidney	B-D ₂

Ground-Water Resources

Ground water is the most important source of stock water in Powder River County. There are 1,990 well and 278 spring appropriations on file at the Montana Bureau of Mines and Geology for the county. The value of ground water in Powder River County can be appreciated by noting the county's land area is 3,298 square miles, the population is approximately 2,800, and there are 2,268 ground-water appropriations reported. (There are probably numerous wells and springs that have not been reported.) A total of 1,533 wells reportedly are used for livestock, 190 for domestic purposes, twenty for irrigation, 202 for a combination domestic and stock use, forty three for other purposes. There are 273 springs used for livestock, one for domestic purposes, and use of four springs is not reported. There are several reports that discuss the geology of parts of Powder River County, but there have been no detailed ground-water reports published that describe the county. The U. S. G. S. in cooperation with the Montana Bureau of Mines and Geology is presently completing a ground-water study that includes most of Powder River County. There are two reconnaissance ground-water reports and a map by the late E. S. Perry, (Montana Bureau of Mines and Geology Memoir 2, Memoir 14, and ground-water resources map of Powder River County), that consider some aspects of ground-water in Powder River County. The town of Broadus uses three drilled wells for a municipal water supply, and residents of other communities obtain water from private wells and springs. (See Table 7 for chemical analyses of two Broadus municipal water supplies.)

The geological history of Powder River County includes long periods of sedimentation and erosion. Geologically, the county is on the western edge of the Black Hills uplift and the eastern edge of the Powder River Basin. The occurrence, movement, and quality of ground water in the county is closely related to geological conditions. Formations of importance to the county's ground-water resources are the Fox Hills and Hell Creek Formations of Cretaceous age (65 to 135 million years old), the Fort Union Formation of Tertiary age (one to 65 million years old), the terrace alluvial deposits of Quaternary age (less than one million years old).

The Fox Hills Formation is exposed over a small area along the eastern edge of Powder River County. The Fox Hills usually consists of layers of thick sandstone and sandy shale. The Fox Hills is widely used as a source of water in southeastern Montana, but in Powder River County

there are good aquifers (water bearing materials) in overlying formations; consequently, the Fox Hills is of less importance. The thickness of the Fox Hills in this area is poorly known, but it is probably one hundred to 150 feet thick. The Fox Hills will probably furnish small to moderate quantities of soft, poor quality water.

TABLE 7

Chemical Analysis of Municipal Water Supplies
(All Figures in Milligrams per Liter)*

<u>City or Town</u>	<u>Broadus</u>	<u>Broadus</u>
Source	Well #1	Well #2
	Fairgrounds	Powerhouse
Date	12/66	12/66
Total Solids	660	420
Hardness	10	0
Ca	4	0
Mg	0	0
Na+K	255	175
CO ₃	0	0
HCO ₃	384	226
SO ₄	225	154
Cl	11	25
NO ₃	0.0	0.0
F	0.7	0.5
Fe	0.3	0.58
As	0.00	0.00
Pb	0.00	0.00
Cu	0.00	0.00
Zn	-	-

* See Appendix I, Table A, for accepted water quality standards

Source: State Department of Health, Helena, Montana

Overlying the Fox Hills Formation is the Hell Creek Formation. The Hell Creek consists of about five hundred feet of sandstone and shale with some thin coal seams. Sandstone layers will yield water to wells, with the lower part of the Hell Creek reported to have higher artesian heads and better yields than the upper part. The contacts of the Hell

Creek with the underlying Fox Hills Formation and the overlying Fort Union Formation are not distinct and are not well mapped in Powder River County. Sandstone layers within the Hell Creek are discontinuous and cannot be traced over long distances. Ground water is present in the Hell Creek in amounts adequate for stock and domestic purposes and is of fair to poor quality.

Overlying the Hell Creek is the Fort Union Formation, which consists of the Tongue River Member (upper), the Lebo Member (middle), and the Tullock Member (lower). The Tullock and Lebo Members are often called the Ludlow Member, or simply the lower member. The lower member is exposed in the eastern part of the county and consists of layers of sandstone, shale, and thin coal beds. The sandstone in this member will yield small amounts of fair to poor quality water to wells.

The upper or Tongue River Member of the Fort Union Formation is exposed along the Powder River and in most of the area to the west. This member consists of beds of sandstone, sandy shale, shale, and coal. The Tongue River where not reduced by erosion is about thirteen hundred to eighteen hundred feet thick. Due to erosion, the Tongue River becomes thinner along the Powder River and thickens to the west and south. Sandstone and coal beds in the Tongue River supply water to numerous wells in central, eastern, and southern Powder River County. Wells are usually two hundred to five hundred feet deep and yield five to twenty gallons per minute of fair to poor quality water. In the Powder and Little Powder River valleys, artesian wells, many of which flow, are common. The Tongue River is probably the most widely used source of stock water in this part of Montana.

Along the Powder and Little Powder Rivers and their tributaries and other major streams there are deposits of Quaternary alluvium, and in some areas stream terrace deposits. Ground water in terrace deposits along the streams has not been studied. Stream terraces are composed of boulders, sand, and gravel, and the thicker terraces may contain sufficient ground water for stock and domestic use.

Alluvial deposits along the Powder and Little Powder Rivers consist primarily of sand and silt. Wells in this alluvium yield water, but there have been numerous problems with sand flowing into the wells. Quality of the water is fair to poor. Where the stream valleys are underlain by shale, the water tends to be poorer in quality than where bedrock is sandstone. Ground water also is present in the alluvium of practically all other large streams in the county.

In summary, sandstone layers in the Hell Creek and Fort Union Formations, and to a lesser extent alluvium along streams, are the most important sources of stock water in Powder River County. There

will be continued development of ground water for livestock and to a lesser extent for domestic purposes. There may be some additional development for municipal purposes, but there are few areas in which water could be developed for irrigation. Additional detailed ground-water studies would assist in the proper development of the county's ground-water resources.

- Sources:
1. M. K. Botz, Montana Bureau of Mines and Geology, Butte, Montana, 1970
 2. State Department of Health, Helena, Montana
 3. U. S. G. S. Water Supply Papers and "Surface Water Records of Montana"
 4. "Water Resources Survey," Powder River County, Montana, Montana Water Resources Board, Helena, Montana, 1961
 5. Weather Bureau, Climatological Data, Montana Section, 1969

THE SOILS

General

General descriptions of soils in specific areas are useful in predicting the potential problems which might be encountered during private and public works construction. Powder River County has an interesting and quite complicated geological history which has greatly influenced the soil structure of the area. The county has characteristic land forms of plains country; however, dominate physiographic features are the Powder River and Little Powder River drainages flanked on the west by a relatively rugged timbered area, a portion which is included in the Custer National Forest.

The soils of Powder River County were derived from parent materials originally located in the valleys and the adjacent rugged hills. The parent materials, which commonly consist of the sedimentary rocks such as sandstone, shale, and other related rocks, were eroded, transported, and deposited by various processes. Thus, the soils resulting consist of stream deposits or alluvium and lake deposits or the alterations of these materials due to various conditions of climate, topography, and living organisms.

Soil Map

The Soil Conservation Service of the United States Department of Agriculture is currently engaged in a detailed soil study of each county in Montana in an effort to produce general soil maps for each county. The soil study for Powder River County has been completed, and a copy of the preliminary general soil map has been made available for this report. This preliminary map is shown in this report as Map 4. In developing this map, along with the other more detailed soil maps, the Soil Conservation Service made field studies and observations which resulted in the designation of nine soil associations. Each soil association, as a rule, contains a few major soils and several minor soils. Soils within an association may differ greatly in short distances, and any one soil may occur in more than one association. Thus, the general soil map does not show the kind of soil at any particular point but shows specific patterns of soils. Detailed soil information for specific areas gathered during the preparation of the general soil map can be obtained from the Soil Conservation Service office in Broadus or the area office in Miles City. It is recommended that all of the available soils information be consulted during the planning of proposed public works projects in Powder River County. Also, on site soil investigations should be performed.

The Soil Conservation Service preliminary draft descriptions of the nine soil associations shown on the general soil map are presented as follows:

1. Bainville-Vebar-Tullock Association. These are silty and sandy upland soils.
2. Bainville-Midway-Nunn Association. These are silty and clayey upland soils.
3. Havre-Lohmiller-Farland Association. These are alluvial silty and sandy soils.
4. Wibaux-Bainville-Midway Association. These are shallow loamy, silty and clayey soils.
5. Promise-Midway-Bainville Association. These are clayey and silty upland soils.
6. Wibaux-Fergus-Relon Association. These are dark loamy upland soils.
7. Farland-Bainville-Morton Association. These are deep loamy and silty upland soils.

8. Campspass-Arnegard Association. These are loamy and silty wooded soils.

9. Midway-Nunn Association. These are clayey upland soils.

Conclusions

The soils of Powder River County have wide ranging characteristics; however, they generally have been easy to deal with where shallow domestic water wells and individual sewage drainfields have been constructed. The large amounts of alluvium and other fine grained surface soil deposits have been found to be extremely variable in permeability, however. This has had an effect on both the quantity of water available in shallow domestic wells and the successful operation of individual sewage drainfields. In areas of extensive clay and silt deposits special care is required in the construction and operation of septic tank drainfields.

Construction of municipal water and sewer systems in the various soils of Powder River County has not been found to be difficult. Pipeline trench digging in the sands and clays is extremely easy while the coarse alluvium or stream gravels slow operations somewhat. Some bedrock can be expected at normal water and sewer line installation depths, as indicated in the soil association descriptions. The brief association descriptions are only intended to indicate general soil types and thus alert those planning construction projects to the possible problems which can be expected. Detailed soil information should be obtained before project planning and construction cost estimating are begun.

Source: U. S. Department of Agriculture, Soil Conservation Service, Broadus, Montana

COMMUNITY WATER SYSTEM FACILITIES

General

This comprehensive report covers the overall problems, existing or projected, for Powder River County, Montana. The volume of data processed and evaluated and the intent of the report allow only a general analysis of any one system.

The intent of this report is to point out the general needs of each community with the objective that each community may in the future be provided with a safe and adequate water system. The general solutions

to overall problems suggested in this report may have to be modified when detailed studies are made. These modifications may be in exact size of parts of a system or in some detailed design variation but will not detract from the overall value of the general information presented.

Basically, the demand for water from community systems is for domestic, fire fighting, and industrial uses. The demand for industrial water supply in small communities has not been extensive in Montana and in most cases will not control the design of community systems. Sufficient water for fire fighting must be considered; however, economic feasibility will usually control the extent of such facilities. In most small communities a system with sufficient capacity to give high ratings for fire protection would require facilities considerably larger than necessary for domestic purposes. The community might be unable to finance such an improvement; the approach, therefore, has been to propose a system suitable for present domestic needs. These basic facilities can be expanded for more complete service and for higher fire ratings as it becomes economically feasible.

The domestic use of water has increased greatly in recent years. This is partially due to improved economic conditions which make it possible for families to acquire such water consuming appliances as dishwashers, waste disposal units, and automatic washing machines. Water use for beautifying property has also increased. The most essential condition is adequate, safe, and potable water for domestic purposes, and this has been the primary consideration in this study. See Appendix II for further comments on analysis criteria.

Basic Considerations

Communities studied in this comprehensive plan were those with a minimum of five potential users and a maximum population of 5,500. Each community within this category was visited at least once. During these visits the type of water facilities available was examined, and an evaluation of the facilities was made from the standpoint of fulfilling the needs of the residents.

The existing systems were found to be quite varied in their operation, condition, and suitability for serving the needs of the users. The situation in each community was evaluated separately; however, some general classification of the various systems was possible. These are described briefly in the following paragraphs so that the general philosophy of the analysis can be shown.

1. In some communities the homes are quite widespread and few in

number. Good water in adequate quantities can be found at reasonable depths, and for such situations private wells will provide a safe and suitable water system.

2. Many communities have had access to good water from private wells for many years. In some of these communities population is increasing, and the area is becoming more densely settled. As a result, tests for bacteriological quality of well water occasionally indicate that pollution is present. When this occurs, it is usually the beginning of a problem which will continue to worsen. Increasing population and a higher potential for contamination indicate the need for a safe community water facility. The system should be one which will serve the domestic needs of the present residents with provisions for improvements and expansion as needed.

3. Many communities have enjoyed a central water system for years but have not made annual improvements and replacements. This has resulted in overloaded and antiquated systems. Suggestions for immediate improvements which will fit into an overall replacement program are included in this report.

4. Some communities which have experienced a steady population growth are finding that their water systems are inadequate for present demands and will require enlargement. Population projections and economic trends are used to determine the need for improvements and also to justify the type and extent of proposed improvements.

Powder River County

The estimated 1970 population of Powder River County is 2,800. Approximately 1,325, or 47.3 percent, of these people are presently served by central water systems, and the remainder are served by private facilities such as wells and springs. By 1990, about 1,225, or 58.2 percent of the population, will have access to central water systems if the schedule of proposed improvements is followed. These figures reflect the steady decline in population which is expected for both the county and community populations during the planning period. It is expected that the percentage of the population not served by central systems will be in outlying areas where homes are not close enough together to make central systems feasible.

Broadus

Existing System. The estimated 1970 population of Broadus is one thousand. Population projections indicate that this town will experience a steady decrease in population during the planning period.

The area presently served by the community water system is shown on Map 5.

Water supply for this system consists of three wells with capacities of three hundred gallons per minute (gpm), 190 gpm, and one hundred gpm and located within the community as shown on the map. Storage for the system is provided by a 100,000 gallon reservoir located on the northwest edge of town. This reservoir is reported to be in good condition. The quality of the water obtained from the well sources is good and no treatment is provided. The distribution system consists of two, four, six, and eight inch diameter pipe all of which are reported to be in good condition. The majority of the distribution system consists of asbestos cement pipe.

In general, adequate flows and pressures have been reported throughout the Broadus water system; however, during periods of high demand low pressures have been reported on the upper side of town. On the average, pressures within the system are over forty pounds per square inch (psi). According to the design analysis criteria used in this report, the present Broadus water system is satisfactory to serve the town throughout the planning period. It is noted, however, that the fringe areas herein called the West Environs and South Environs of Broadus are not served by central water or sewer facilities, and it is proposed that they be served during the planning period. It is believed that the Broadus water system can be expanded to serve these outlying areas, and it is recommended that this be done.

Improvements by 1990. The population of Broadus is expected to be 750 by 1990. The combined populations of the West and South Environs of Broadus is to be 215 by 1990. During this period it is proposed that a well capable of producing one hundred gpm be established in the West Environs of Broadus as shown on Map 6. A water supply system consisting of six inch diameter pipe and connected to the Broadus system is proposed. The addition of a 100,000 gallon storage facility in the same location as the existing storage facility would supplement the water supply needed to serve the South and West Environs of Broadus. It is proposed that the South Environs of Broadus be served by extending a six inch water line to this area from the Broadus system. The area served by this extension is also shown on Map 6. The addition of extra supply and storage capacity will offset the demands on the present system incurred by expanding to serve the fringe areas, and the resulting expanded system will be adequate to serve the entire community throughout the remainder of the planning period.

Bell Creek

Existing System. The estimated 1970 population of Bell Creek is 325. Population projections indicate that this town will experience a steady decrease in population throughout the planning period. A central water system presently exists, and the layout of this system is shown on Map 7. The town of Bell Creek receives its water supply from a drilled well located south of the community. The capacity of the well is ninety gpm. Storage for the water system is provided by a 125,000 gallon steel storage tank located on a hill north of town. A six inch plastic supply pipe carries water from the well to the storage tank. Water distribution for the community is provided by two, four, and six inch diameter plastic pipe. The entire community of Bell Creek is served by this water system which was constructed in 1967. There is no treatment for the water obtained from the well, and the quality of the water is considered to be good. No major problems with this system have been reported, and major improvements or additions are not anticipated. According to the design criteria of this report, water supply in this system is less than half that required. Storage for the system, however, substantially exceeds that required by this criteria. The end result is that considering the required fire reserve and utilizing an eighteen hour pumping schedule, the supply available per capita easily exceeds that which is required by modern day standards.

Improvements by 1990. By 1990 the population of Bell Creek is expected to be two hundred. The present water system will continue to serve the community adequately during the planning period, and other than normal system maintenance it is not anticipated that any improvement will be necessary during this period.

Biddle

Existing System. The 125 persons who presently reside in this community obtain their water supply from private wells. The quality of water obtained from these wells is generally good, and satisfactory quantities are available. Wells in the area range from less than one hundred to over one thousand feet in depth. Population projections indicate that the population of this community will decrease steadily throughout the planning period. A central water supply system would be feasible should problems with individual supply systems develop. If these problems develop or if local demand for such a system materializes, it is recommended that planning and construction take place during the planning period.

Improvements by 1990. By 1990 the population of Biddle is expected to be sixty. Should the local demand for a central water system

facility develop, the layout for a system which would serve the community is shown on Map 8. A well with a capacity of thirty five gpm could be developed within the community, and storage for the system could be provided by a fifteen thousand gallon tank located on a hill west of the community. Supply and distribution piping would be four inch diameter, and service could feasibly be provided for a wide-spread area.

COMMUNITY SEWER SYSTEM FACILITIES

General

Each use of water adds some material or alters some characteristic enough to change the original quality of the water and often to pollute it. The transportation and dilution of municipal, industrial, and agricultural wastes are important and necessary uses of water; therefore, special emphasis is placed on the control of water pollution from these sources. Some of these wastes can be carried in limited amounts without damage to the resource. Some wastes if discharged into water courses can make their way into underground aquifers and pollute the ground water so that it is unsuitable for further use.

Pollution by definition and interpretation is a matter of degree. Since it is inevitable that the quality of water will be altered with each use, it is of critical importance to control the degree of pollution.

It is public policy established by the state legislature to maintain reasonable standards of purity for the water of the state. These standards are to be consistent with the use of these waters, including their use in carrying away the water borne waste products of society. The current Federal Water Pollution Control Act in reference to pollution abatement gives the individual states discretion in assessing the physical and economic feasibility of complying with water quality standards. The "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" of the Montana Water Pollution Control Council for streams and rivers in Montana have been included in Appendix I.

Sewage may be broadly categorized as domestic or municipal waste, industrial waste, and animal or agricultural waste. Animal wastes are usually not involved in community sewage facilities; however, they do constitute a potential source of pollution which must be controlled and prevented from entering streams or other potential water supplies.

Although industrial activity throughout Montana has been limited, the need for control and treatment of industrial wastes is apparent. Industrial wastes vary in quantity and composition as greatly as the products and processes which generate them. They include toxic chemicals, solids carried in suspension, brines, strong acids and alkalies, oils, dyes, floating solids, and the heat generated by industrial processes. Industrial wastes are not found to be a major factor in the design of most community sewage facilities. Where economic projections indicate industrial development, the relationship to loading on domestic sewer systems is considered.

Domestic sewage is the primary consideration of this study and has been the basis for design and analysis. Where particular systems are subjected to loading from industrial sources, a more detailed study will be necessary. The general approaches outlined in "Analysis Criteria" in Appendix III will suffice in practically all cases.

Basic Considerations

There are generally three main methods of sewage disposal. These are septic tanks, mechanical sewage treatment plants, and wastewater stabilization ponds. Local soil conditions, availability of land, and density of population are the basic factors which govern the selection of a particular method.

Many of the smaller communities have relied on individual septic tanks and cesspools for each home to handle sewage disposal. Septic tanks are suitable if the population density is low and if the systems are properly designed and maintained. Overflow from these tanks must drain into the soil and, depending on local soil conditions, may or may not create a problem. There is a limit to the amount of water that even loose granular soil can absorb. Density of population and the length of time the effluent has been entering the soil are factors which indicate whether septic tanks can be suitable for sewage disposal.

When economically feasible, community sewage collection and disposal systems are much more desirable than individual systems. Community systems eliminate the worry of septic tank failure, the danger of well contamination, and the problem of soil saturation. However, it is usually uneconomical to serve a few homes scattered over a large area with a community sewer system.

The type of sewage disposal facilities to be used can generally be determined on the basis of economic factors. Mechanical treatment plants provide an excellent means of sewage disposal although the

initial cost, maintenance cost, and power cost are usually high. Wastewater stabilization ponds are an ideal method of sewage disposal and usually are the most economical to construct and maintain.

The Montana Water Pollution Control Council has established the criteria that treatment of domestic and industrial wastes shall be secondary treatment or its equivalent. For domestic sewage, mechanical treatment plants or stabilization ponds, when either is properly designed, constructed, and operated, meet these requirements.

A schedule for completion of secondary treatment facilities by communities across the state has been established by the State Department of Health. The target date is included for individual towns when applicable.

Powder River County

In Powder River County the communities of Broadus and Bell Creek are presently served by community sewer facilities. Approximately 1,325, or 47.3 percent, of the county population are served by these facilities. By 1980 about 1,565, or approximately sixty percent, of the population will have access to community sewer facilities if the proposed expansion program is followed. It must be realized that these figures reflect the population projections which indicate a decrease in population for the communities and the overall county population during the planning period. It is expected that the remaining population not served by central sewer facilities will consist of those people living in outlying areas where the homes are not close enough together to make community sewer systems feasible.

Broadus

Existing System. The 1970 population of Broadus is estimated to be one thousand. Population projections indicate that this population will decrease steadily during the planning period. A community sewer system facility is in existence, and the layout is shown on Map 9.

A collection system, consisting of six and eight inch diameter sewer pipe, carries sewage by gravity from the town to the treatment facility northeast of town. A lift station lifts sewage into the treatment facility provided by a 6.7 acre wastewater stabilization pond. The central sewer system serving Broadus was constructed in 1947, and the wastewater stabilization pond was constructed in 1963. The present system operates satisfactorily, and no major problems have been reported. The design criteria of this report indicates that the

lagoon acreage will have to be increased to serve the community adequately during the planning period. Also, it is recommended that the system be expanded sufficiently to handle the addition of the fringe areas herein called the West Environs of Broadus and the South Environs of Broadus shown on Map 10.

Improvements Next Five to Ten Years. The population of Broadus is expected to be 950 by 1975. A combined population of the West and South Environs of Broadus is expected to be 255 by 1975. During this period the wastewater stabilization pond should be expanded to enclose an additional water surface area of 5.5 acres. It is proposed that the collection system be extended to serve the South and West Environs of Broadus. In order that the West Environs of Broadus can be served adequately, a lift station will be required to force sewage through a four inch force main to the existing Broadus collection system. The proposed facilities and the areas to be served are shown on Map 10. The addition to the existing Broadus wastewater stabilization pond will be adequate to handle the needs of the combined communities throughout the remainder of the planning period.

Improvements by 1990. By 1990 the population of Broadus and the South and West Environs of Broadus is expected to be 965. The sewer system as described in the five to ten year plan will be adequate to handle the needs of the projected 1990 population. During this time no other major improvements or enlargements to the system will be necessary.

Bell Creek

Existing System. The present population of Bell Creek is estimated to be 325. This population is expected to decrease steadily throughout the planning period. A community sewer system facility is in existence, and the layout of this system is shown on Map 11.

A collection system, consisting of eight inch diameter sewer pipe, carries sewage by gravity to the treatment facility as shown on Map 11. Treatment for the system consists of a one acre wastewater stabilization pond located near the southern edge of the community. As shown, a lift station provides service for the trailer development in the southwestern portion of the community. The sewage collection facility is adequate for present and future needs; however, the treatment facility is undersized and should be expanded during the planning period. The entire existing system was constructed in 1967 and is in good condition.

Improvements Next Five to Ten Years. By 1975 the population of Bell Creek is expected to be 350. During this period it is proposed that

the wastewater stabilization pond capacity be increased by the installation of aeration facilities to increase the overall capacity of the treatment facility to 35,000 gallons per day (gpd). A reevaluation of the population trends during this portion of the planning period may indicate that less treatment capacity than this will be required. It is expected that the existing sewage collection system will continue to serve the community adequately.

Improvements by 1990. By 1990 the population of Bell Creek is expected to decline to two hundred. The sewage collection and treatment facility as described and improved during the five to ten year planning period will continue to serve the community adequately, and only normal maintenance to these facilities will be required during the remainder of the planning period.

Biddle

Existing System. The 1970 population of Biddle is estimated to be 125. This population is expected to decrease steadily throughout the planning period. At this time, sewage in Biddle is handled by individual septic tanks and drainfields. There have been no pollution or contamination problems reported with these individual systems as the soil in the area receives drainage satisfactorily. At the present time the community has not considered the construction of a central sewage disposal system; however, future population characteristics for this area may be affected by the installation of a central sewer system facility.

Improvements Next Five to Ten Years. The population of Biddle is expected to be 125 by 1975. A community sewer system which would serve the community adequately is shown on Map 12. The layout as shown with the treatment facility located along the Little Powder River northeast of the community would serve the entire Biddle development by gravity. Treatment for the facility would be provided by a 1.25 acre wastewater stabilization pond. The collection and outfall system would consist of eight inch diameter sewer main.

Improvements by 1990. By 1990 the Biddle population is expected to be sixty. The 1.25 acre wastewater stabilization pond recommended in the five to ten year plan will be adequate to serve this projected population. No other major improvements or enlargements will be necessary unless population trends do change and enlargement of the collection system is required to serve the new areas of development.

PREFACE TO MAPS

The following maps have been prepared from several sources. The county maps were prepared from Transverse Mercator Projection Series Maps and Montana Highway Department Maps, Planning and Survey Series. The reduction of the county maps necessary for this publication makes them useful for general reference purposes only.

The town and community base maps used herein are taken from Montana State Highway Commission City and Town Plats prepared from aerial photographs dated 1961 to 1969 and have been updated where necessary. On-site surveys, plats obtained from individual towns, and aerial photography conducted in 1970 were also used. Uncontrolled mosaics have been used and scales are, accordingly, only approximate and are shown for referencing purposes only. The mapping operation was supplemented by field checks made during 1970.

Land use information was obtained by field surveys, supplemented and checked by aerial photography during 1969 and 1970.

Water and sewer systems maps show existing facilities for individual towns and communities except where the information was not available. Data concerning these community facilities was obtained from the records of the individual communities and of the State Department of Health. Water and sewer lines are shown in the center of streets to indicate the existence of lines rather than precise locations. The sizes of lines, obtained from the most current information available, are indicated when possible. The locations of recommended improvements are given as relative locations and are not meant to be scaled from the individual town or community maps.

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MAP I

COUNTY MAP
GENERAL RELIEF

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

ROADS-HIGHWAYS
 STATE HIGHWAY  U. S. HIGHWAY

 RAILROADS

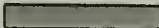
 STREAMS-LAKES

 COUNTY BOUNDARY

 INDIAN RESERVATION

 0-3,000 FT. ELEVATION

 3-5,000 FT. ELEVATION

 5-7,000 FT. ELEVATION

 OVER 7,000 FT. ELEVATION

MAP 2

LEGEND

MAJOR STATE-WIDE COVERAGE

POWER AND GAS SYSTEMS

-  POWER PLANT (IN MEGAWATTS)
-  1 to 50 KILOVOLTS
-  51 to 100 KILOVOLTS
-  101+ KILOVOLTS
-  PROPOSED LINES
-  GAS LINES

RECREATION AREAS

1. LOST CREEK STATE PARK
 2. LEWIS AND CLARK CAVERNS STATE PARK
 3. LAKE MARY RONAN STATE PARK
 4. MEDICINE ROCKS STATE PARK
 5. ROSEBUD STATE PARK
 6. ROCK CREEK STATE PARK
 7. MAKOSHIKA STATE PARK
 8. WEST SHORE STATE PARK
 9. WOODS BAY STATE PARK
 10. BITTERROOT LAKE STATE PARK
 11. ASHLEY LAKE STATE PARK
 12. LONE PINE STATE PARK
 13. JAMES KIPP STATE PARK
 14. HOOPER MEMORIAL STATE PARK
 15. HELL CREEK STATE PARK
 16. FINLEY POINT STATE PARK
 17. ELMO STATE PARK
 18. FLATHEAD LAKE STATE PARK
 19. YELLOW BAY STATE PARK
 20. WALSTAD MEMORIAL PARK
 21. THOMPSON FALLS STATE PARK
 22. WHITEFISH LAKE STATE PARK
 23. WAYFARERS RECREATION AREA
 24. TIBER RESERVOIR RECREATION AREA
 25. CLARK CANYON RESERVOIR RECREATION AREA
 26. ENNIS RECREATION AREA
 27. DEADMAN'S BASIN RESERVOIR RECREATION AREA
 28. PAINTED ROCKS RESERVOIR RECREATION AREA
 29. CANYON FERRY RECREATION AREA
 30. LOGAN PARK RECREATION AREA
 31. NELSON RESERVOIR RECREATION AREA
 32. BEAVERTAIL HILL RECREATION AREA
 33. GLACIER NATIONAL PARK
 34. YELLOWSTONE NATIONAL PARK
-  NATIONAL FORESTS

MAP 3

COUNTY MAP LAND OWNERSHIP

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

ROADS-HIGHWAYS

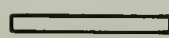
———— STATE HIGHWAY U. S. HIGHWAY

— — — — RAILROADS

 STREAMS-LAKES

- . - . - . COUNTY BOUNDARY

 INDIAN RESERVATION

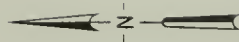
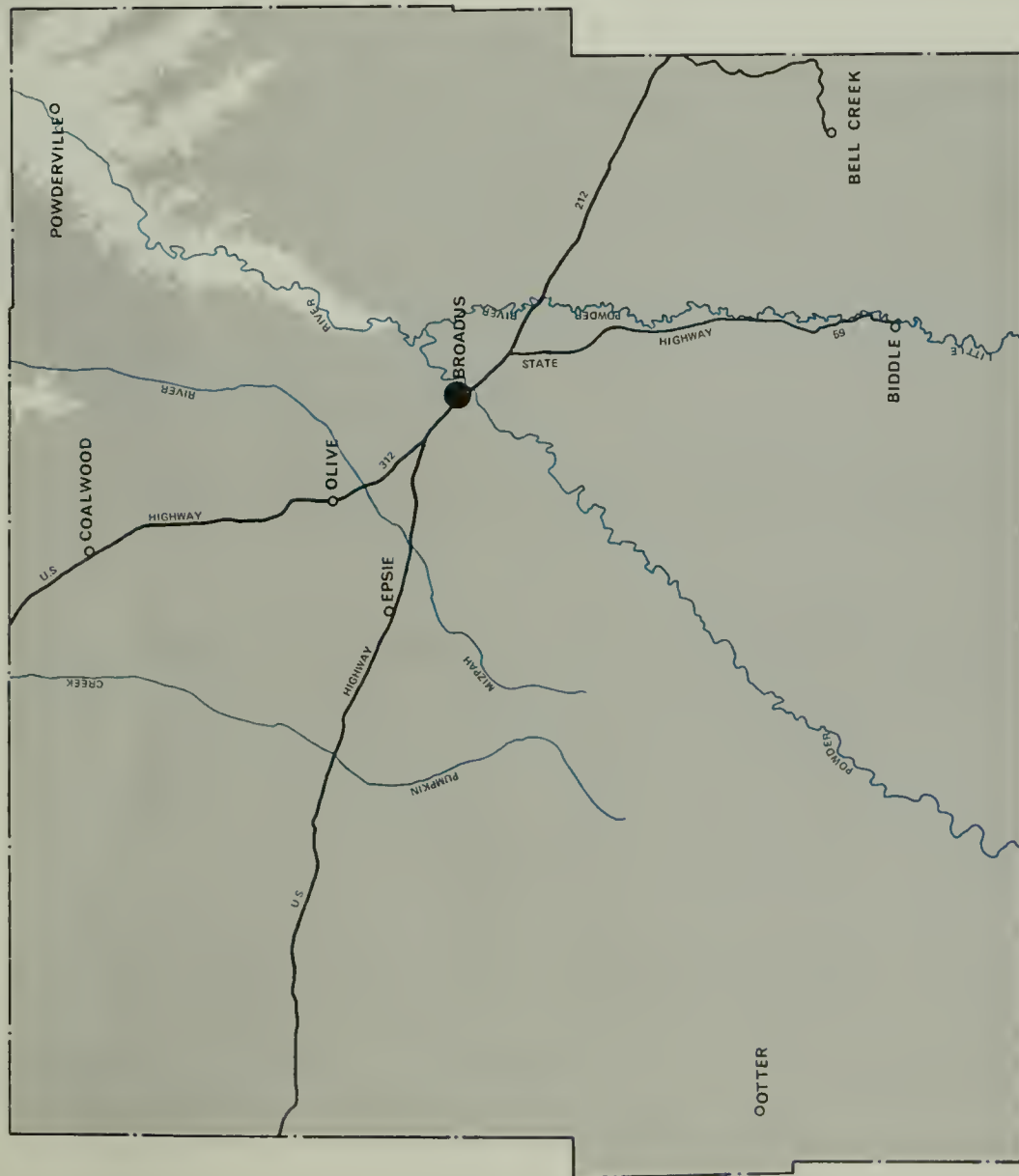
 PRIVATELY OWNED LAND

 STATE OWNED LAND

 FEDERAL OWNED LAND

CITIES MAP LEGEND

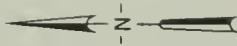
LAND USE	WATER and SEWER SYSTEMS
 SINGLE RESIDENCE	 EXISTING LINES AND SIZES
 DILAPIDATED RESIDENCE	 PROPOSED LINES 5-10 YEAR
 SINGLE TRAILER RESIDENCE	 PROPOSED LINES 10-20 YEAR
 MULTIPLE RESIDENCE	 EXISTING LIFT STATION
 APARTMENTS	 PROPOSED LIFT STATION
 TRAILER COURT	 EXISTING WATER STORAGE TANK
 COMMERCIAL BUILDING	 PROPOSED WATER STORAGE TANK
 HOTEL-MOTEL	 EXISTING WATER SOURCE
 PUBLIC BUILDING	 PROPOSED WATER SOURCE
 SCHOOL	 EXISTING TREATMENT FACILITIES
 CHURCH	 PROPOSED TREATMENT FACILITIES
 HOSPITAL	 SERVICE AREA 1970-1980
 INDUSTRIAL	 SERVICE AREA BY 1990
 GRAIN ELEVATOR	



POWDER RIVER COUNTY TOPOGRAPHY



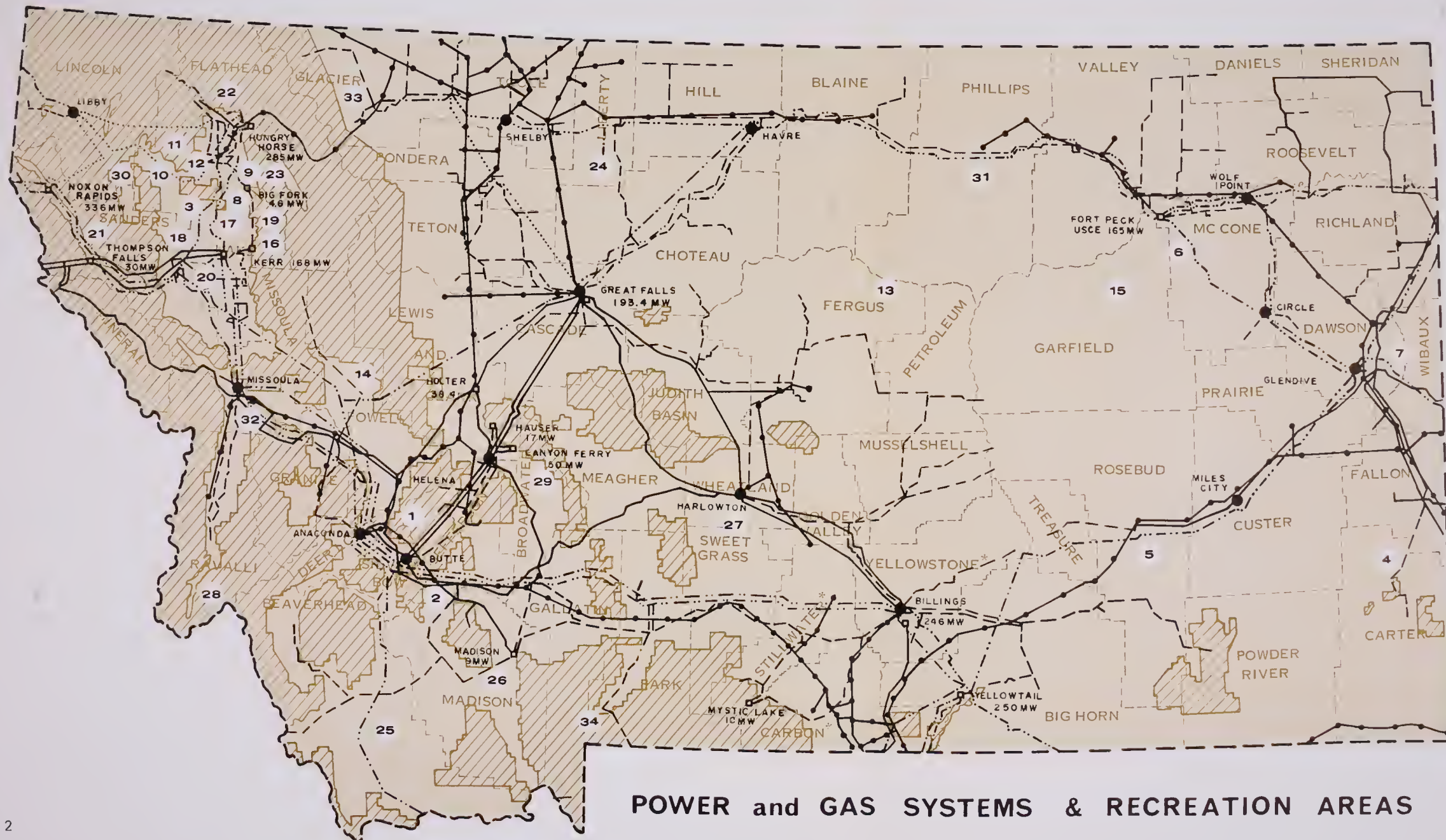
MAP 1

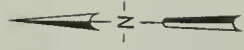
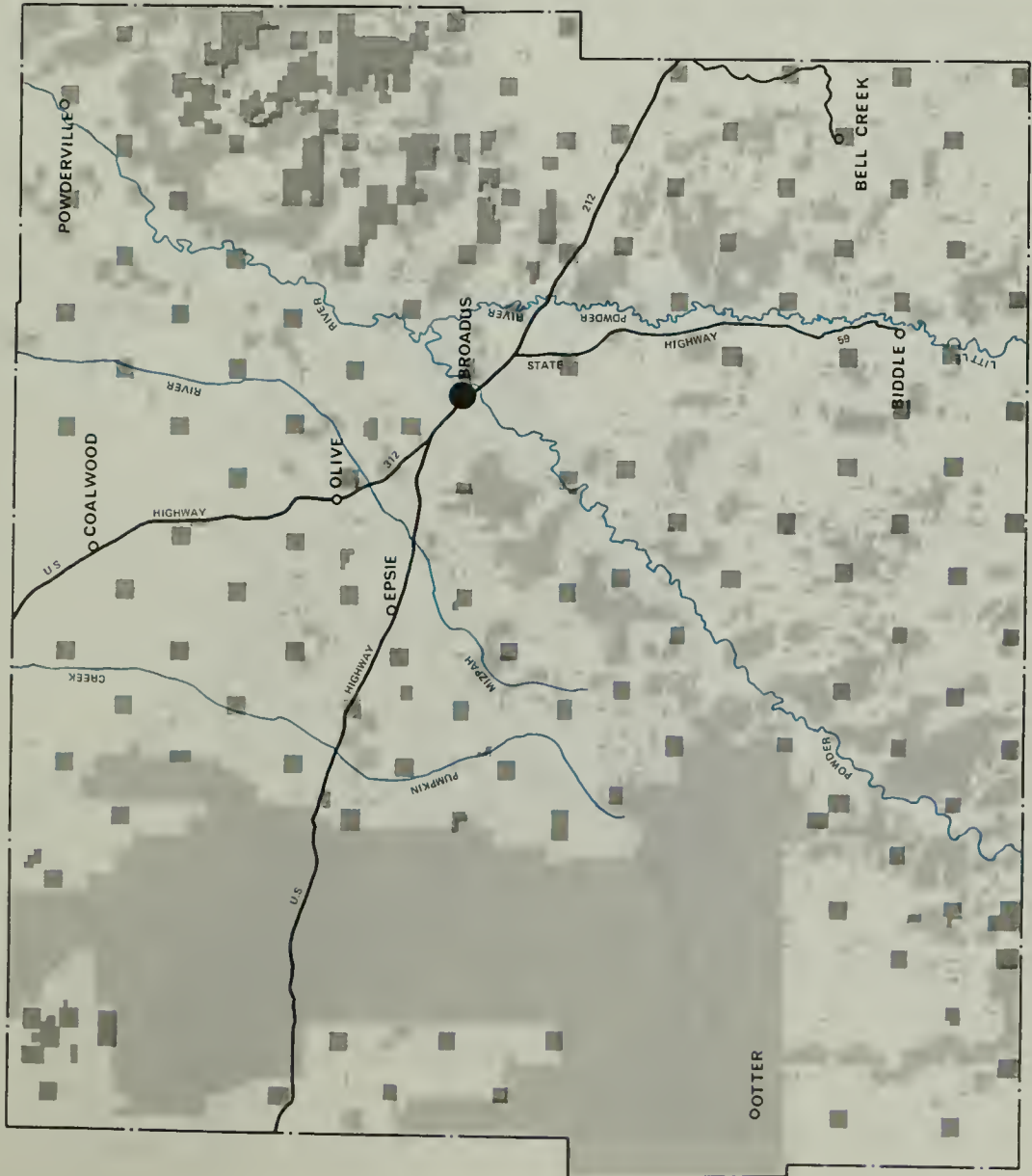


DER RIVER COUNTY
LAND OWNERSHIP



MAP 3

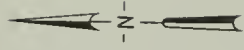
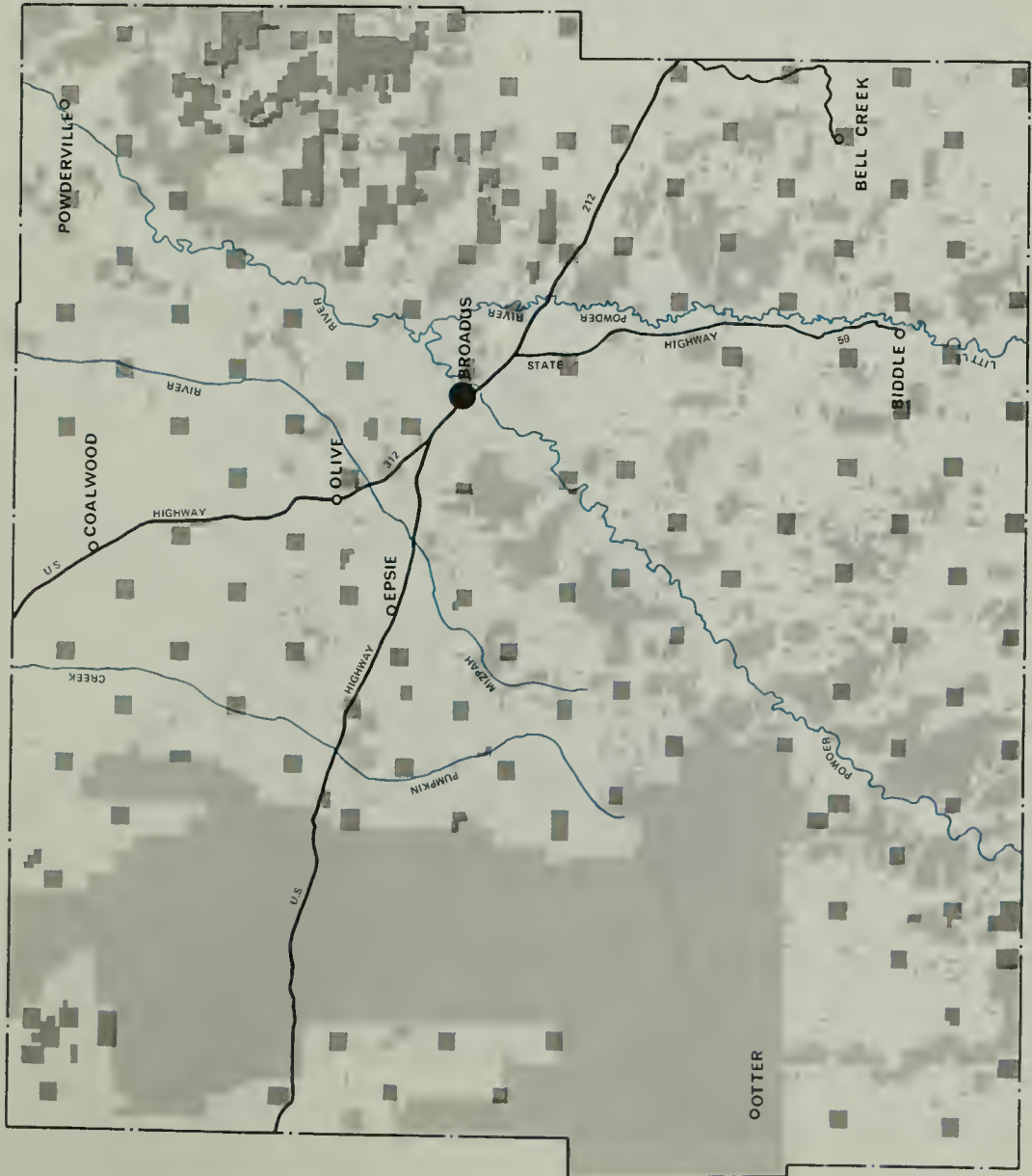




POWDER RIVER COUNTY
LAND OWNERSHIP



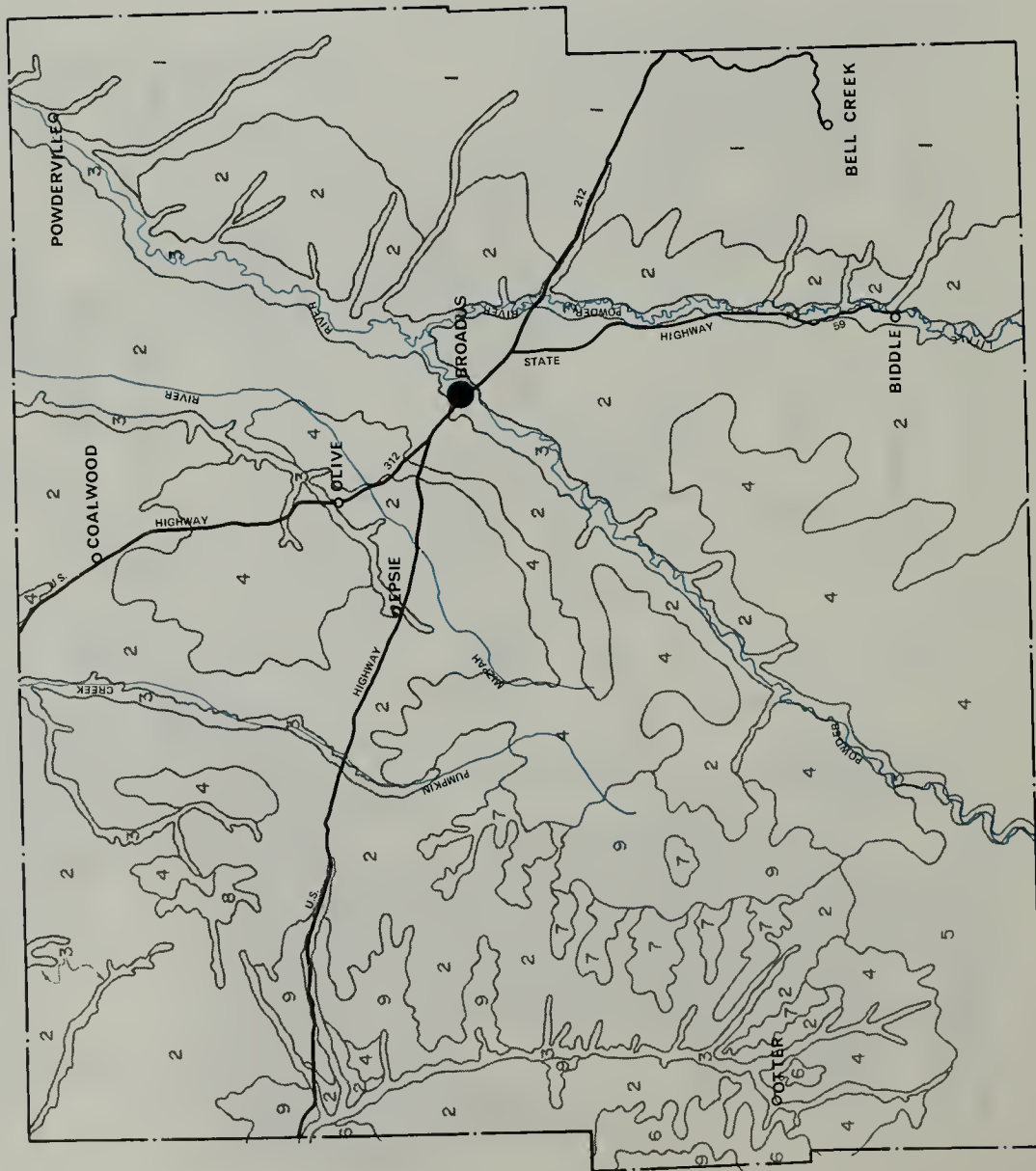
MAP 3



POWDER RIVER COUNTY
LAND OWNERSHIP



MAP 3

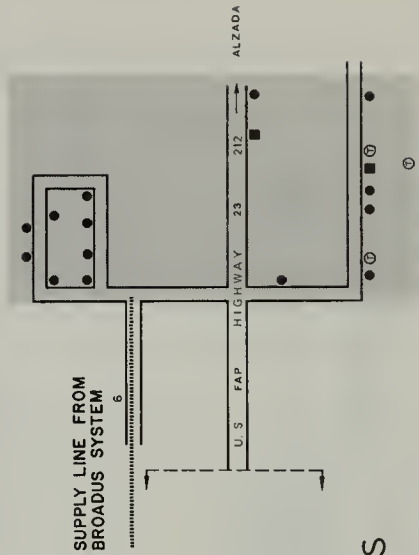


POWDER RIVER COUNTY SOILS

SCALE
0 5 10 miles

MAP 4

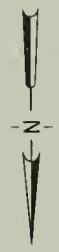
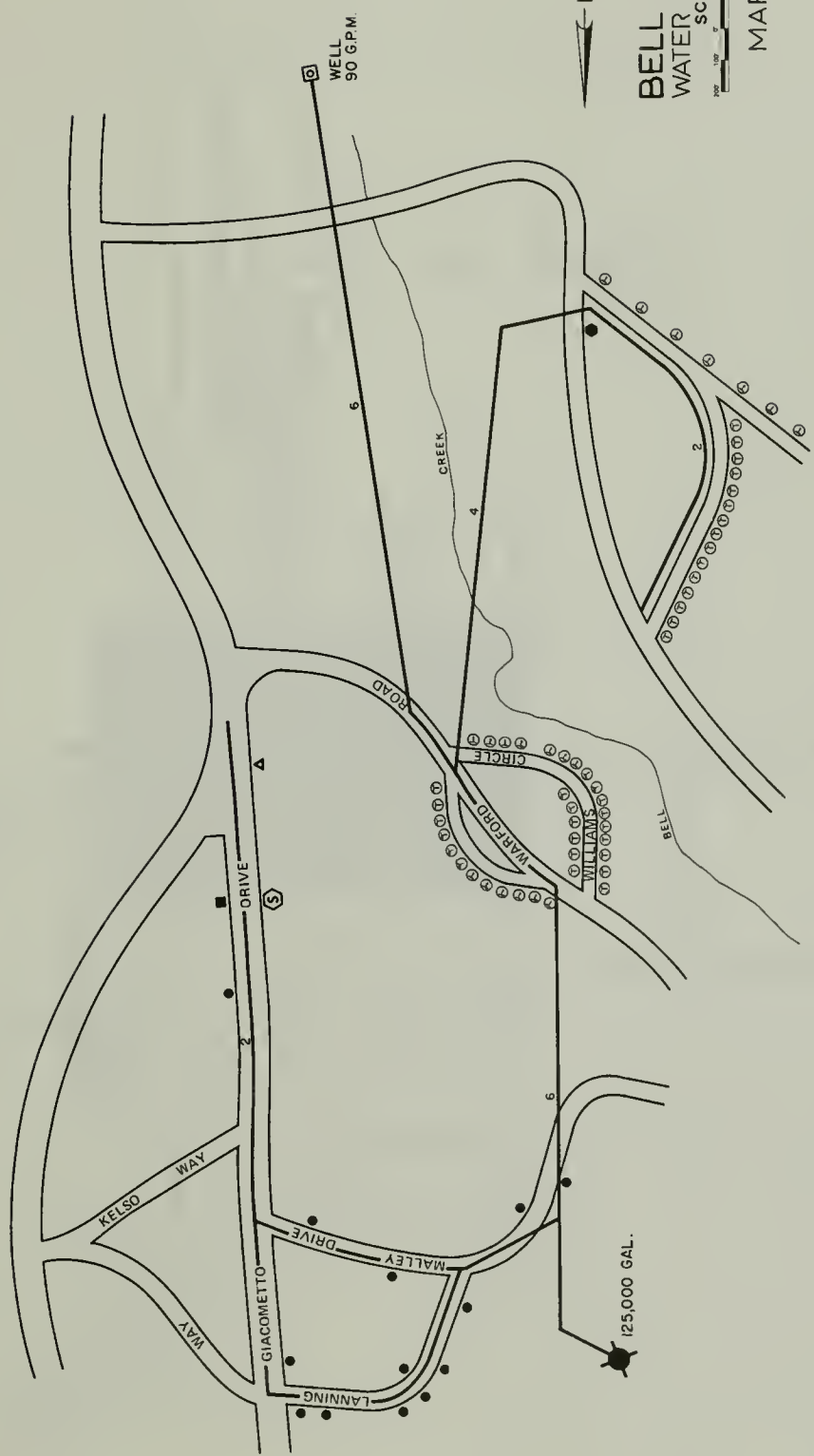
NOTE: Numbers correspond to soils descriptions listed in the text.
SOURCE: USDA Soil Conservation Service



ENVIRONS OF BROADUS WATER SYSTEM

SCALE
0 1000 2000 3000 4000
MAP 6

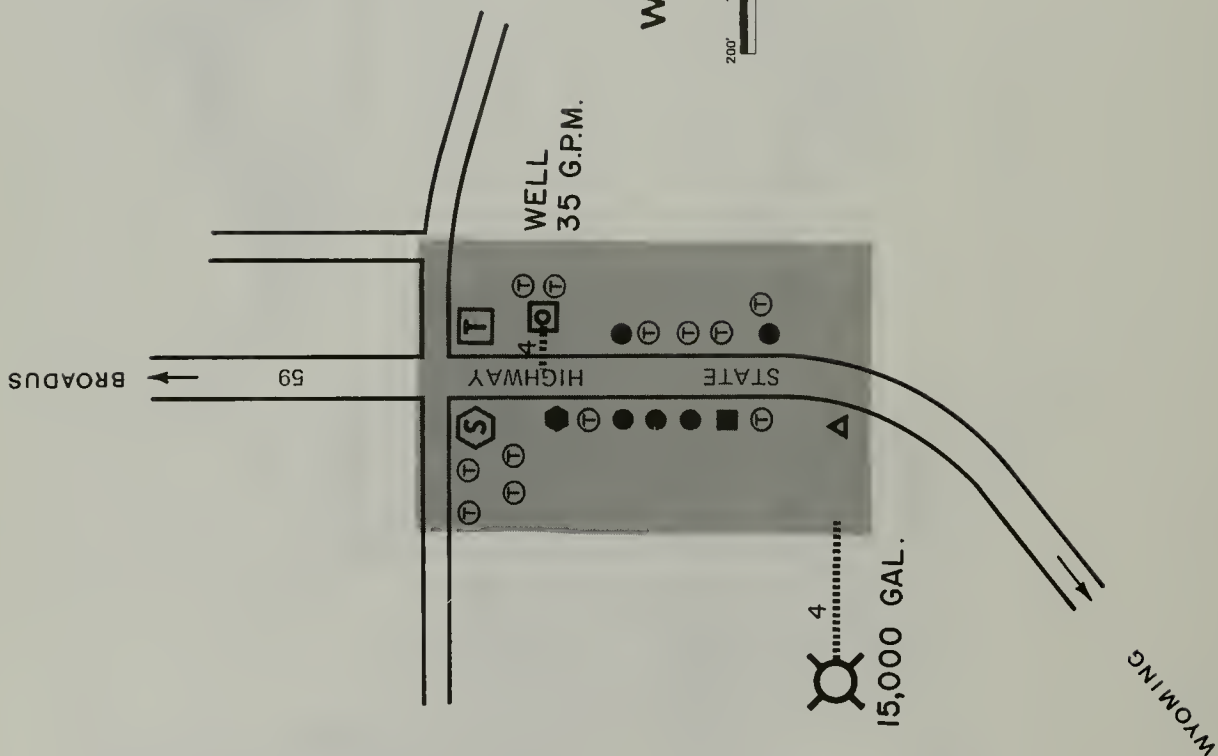
SOUTH



BELL CREEK WATER SYSTEM



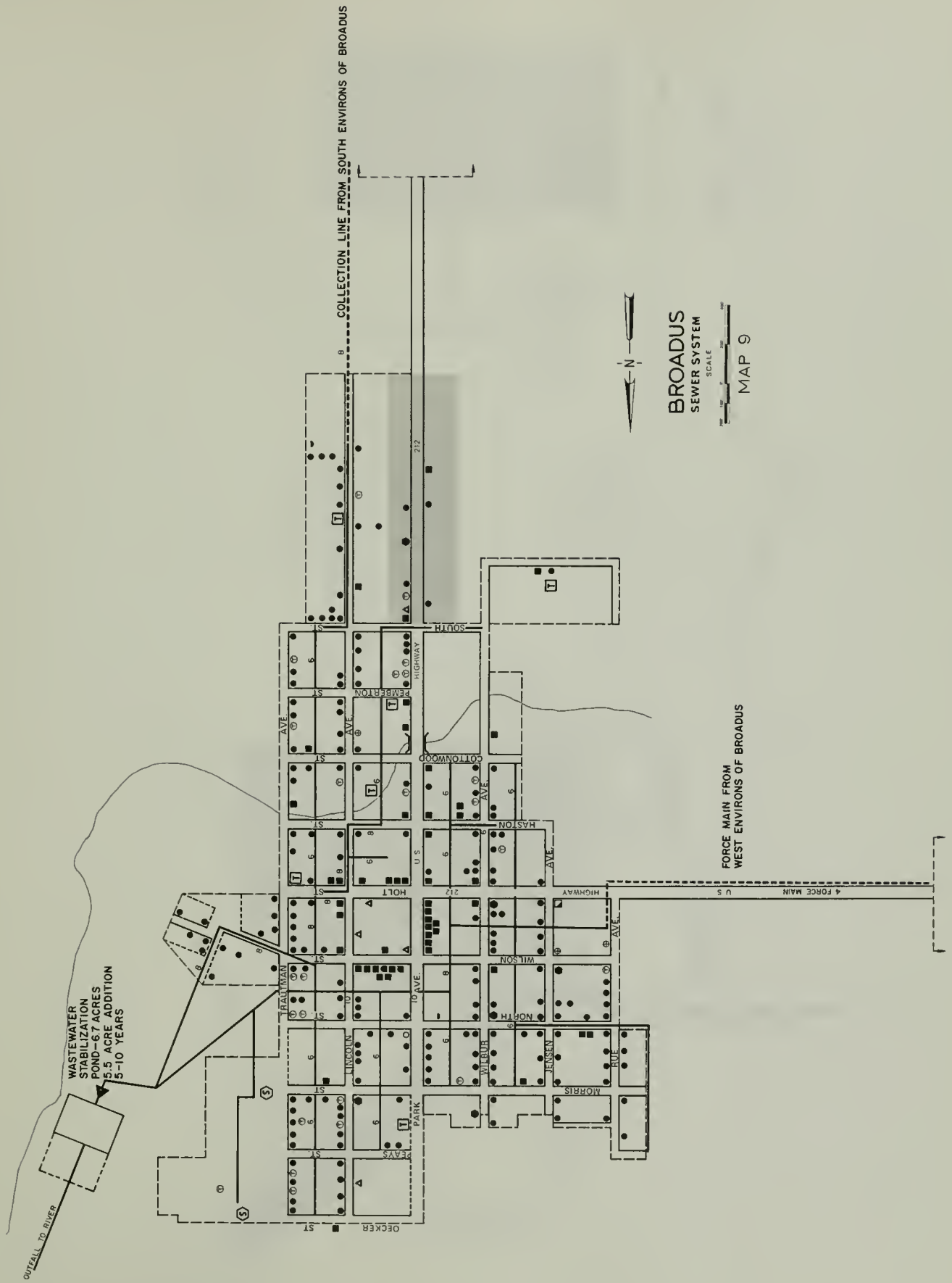
MAP 6

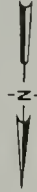
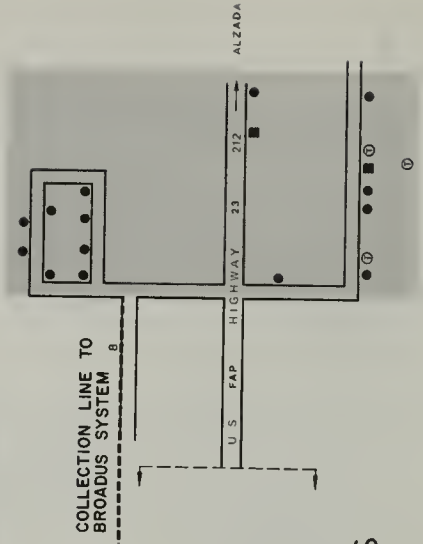
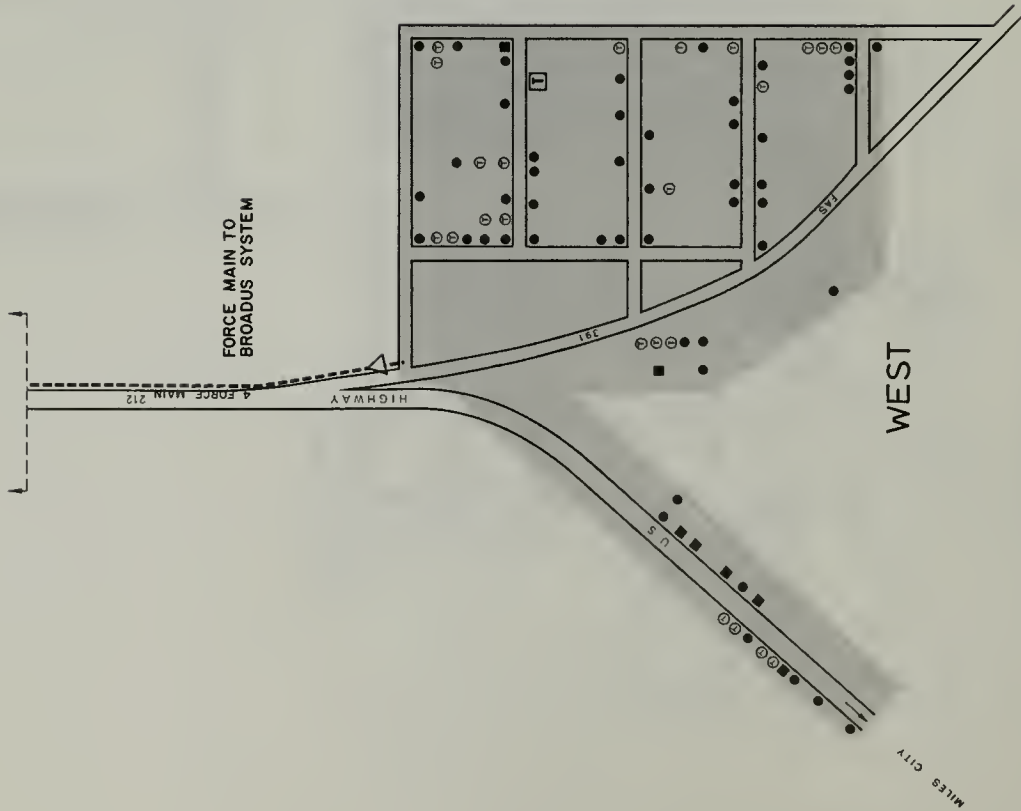


BIDDLE WATER SYSTEM



MAP 8

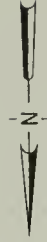
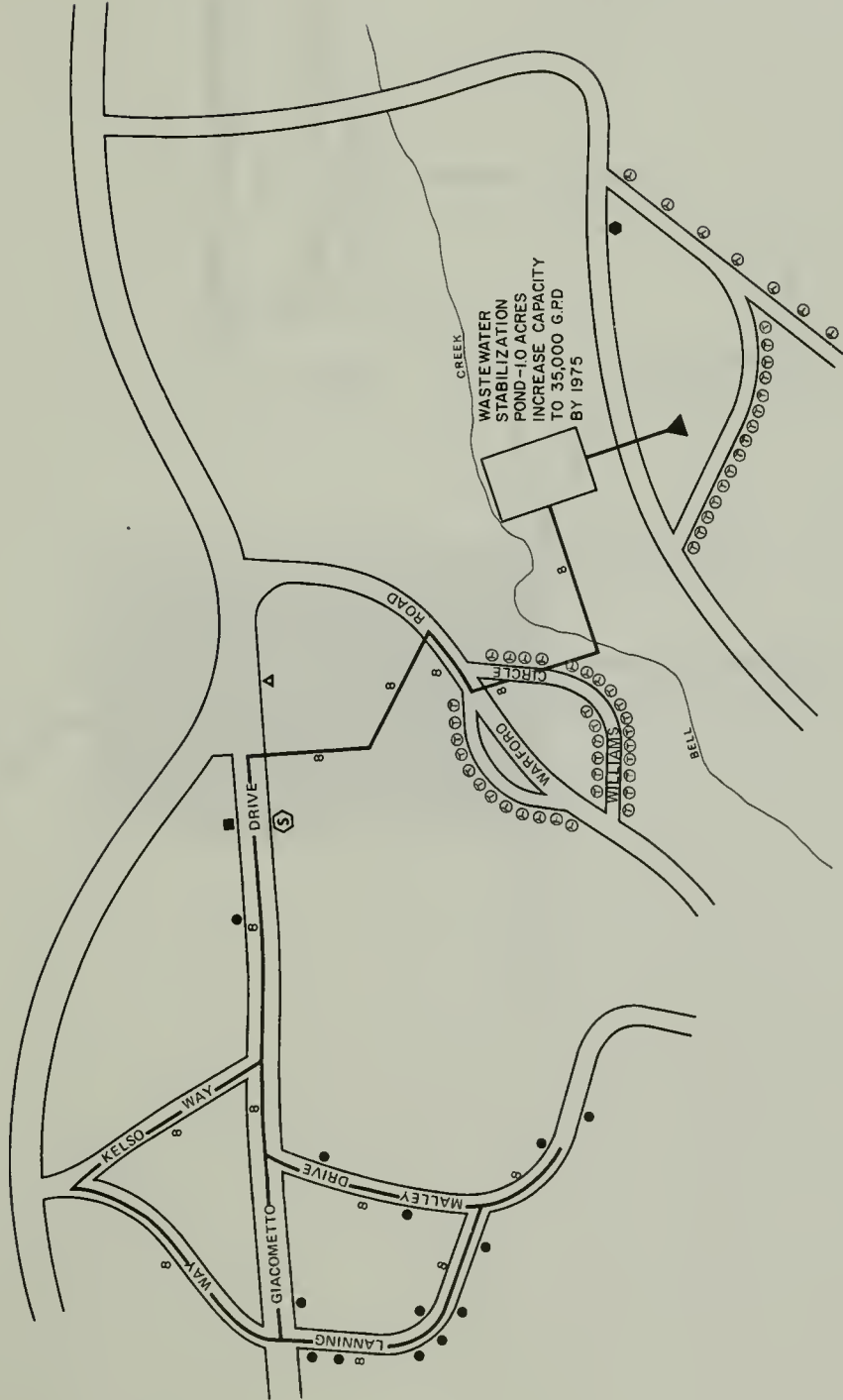




ENVIRONS OF BROADUS SEWER SYSTEM

SCALE
1" = 100'
0' 100' 200' 300' 400'

MAP 10

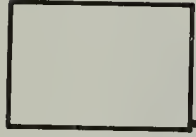


BELL CREEK SEWER SYSTEM

SCALE
1" = 100'
0 100 200 300 400

MAP 11

WASTEWATER
STABILIZATION
POND-1.25 ACRES



8

BROADUS

59

STATE HIGHWAY

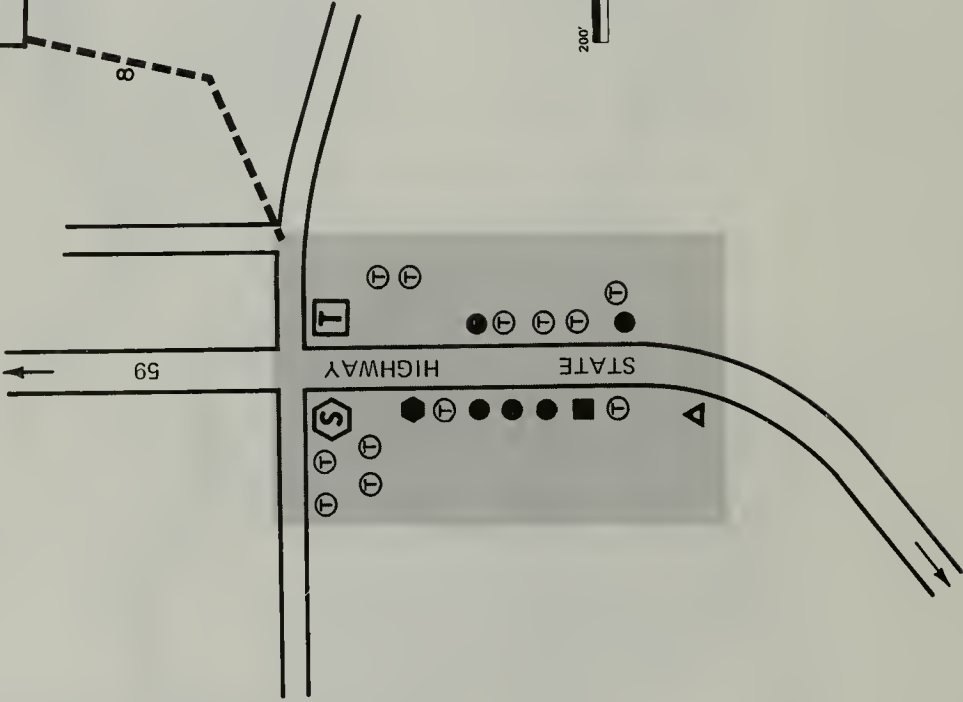
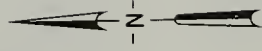
WYOMING

BIDDLE SEWER SYSTEM

SCALE



MAP 12



FALLON COUNTY

MONTANA

FALLON COUNTY
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CONCLUSIONS, RECOMMENDATIONS, AND PRIORITIES

Conclusions

The total population of Fallon County is expected to decrease during the planning period. Baker is the only community within the county which is predicted to show an increase in population. The smaller communities will decrease in population along with the rural population in outlying areas.

The existing community water and sewer systems in Baker and Plevna are in generally good condition and only slight improvements or alterations are proposed. The projected increase in population in Baker will require the existing water system be expanded to provide the town with an adequate water supply. The sewer system in Baker and the water and sewer systems in Plevna will be adequate for the needs throughout the planning period, and only expansion to serve growth areas and normal system maintenance will be required.

Recommendations

This plan shows the various types of improvements which the communities should be considering during the planning period. Elaborate systems are not proposed but rather those facilities necessary to provide safe and adequate community systems. It is recommended that this general plan be adopted by the governing agencies of each community. A detailed approach, which must be undertaken to insure completion of the improvements in each community, cannot be covered in a report of this type. Community leaders, however, do have several courses of action which may be taken.

Most small communities do not have the means to plan and finance complete water and sewer systems. Therefore, to enable communities to acquire such facilities, five departments of the Federal Government have legislation authorizing loans or grants for construction of public works. These agencies are:

Farmers Home Administration
United States Department of Agriculture
P. O. Box 850
Bozeman, Montana 59715

Federal Water Quality Administration
United States Department of the Interior
% Montana State Department of Health
Helena, Montana 59601

Public Health Service
United States Department of Health, Education, and Welfare
Division of Indian Health
Billings, Montana 59101

Administration for Metropolitan Development
United States Department of Housing and Urban Development
Assistant Regional Administrator
Denver Regional Office
1050 South Broadway
Denver, Colorado 80209

Economic Development Administration
United States Department of Commerce
Montana Field Coordinator
207 Medical Arts Building
Butte, Montana 59701

The legislation is constantly changing; therefore, community leaders should investigate the various alternatives and determine which program and course of action would be most beneficial to them.

Priorities

That a particular system requires immediate improvements and another system will be satisfactory for a definite period are difficult to establish. Several indicators for establishing priorities are available, however. The general health of the people is the prime consideration, and this can only be insured when safe water supplies are provided. Water supply in adequate quantities is another important factor. Waste water must be treated and disposed of by safe methods to minimize the problems of pollution and to protect public health. The total number of persons benefited by any improvement must also be considered. These basic criteria were used in establishing the following priority listing:

1. Baker Water System. Although the present water system facility for Baker is serving the town adequately, current population projections indicate the facility will be undersized during the planning period. It is recommended that the improvements to this facility be constructed as proposed.

2. Plevna Water System. Although no serious problems have been reported to date, continued planning and construction of minor improvements to this water system should be carried out during the planning period.

3. Baker Sewer System. No problems are apparent with the existing system, and the treatment facility for this system is adequate for the needs throughout the planning period; however, continued expansion of the collection system to serve the growth areas is important and should be carried out throughout the planning period.

This list of priorities is not intended to govern the order in which action should be taken. The order merely ranks the severity of the problems and the need for improvements.

THE LAND

General Characteristics

Fallon County is located in the southeastern portion of the state and is bordered by Wibaux County on the north, Prairie and Custer Counties to the west, Carter County on the south, and the States of North Dakota and South Dakota on the east. The total area is 1,663 square miles. The only water surface areas of importance are O'Fallon Creek which cuts through the western portion of the county, and Beaver Creek, which runs a short distance in the northeastern corner.

The topography on Map 1 indicates that the land is generally flat and interspersed with numerous small coulees and breaks; there are several higher peaks located in the southern part of the county. Elevations vary from a low of around 2,500 feet above sea level to a high of 3,551 feet located in the south central part of the county. The lower elevations are generally found in the valley areas surrounding Cabin Creek in the north.

One federal highway and one state highway run through the county in addition to the lesser classification types. U. S. Highway 12 enters from North Dakota on the east and passes through Baker enroute to Miles City. State Highway 7 also runs through Baker on a north south route. Travel to other parts of the county is provided by several gravel and dirt roads.

Rail transportation is provided by the Chicago, Milwaukee, St. Paul, and Pacific Railroad. The line is connected to Terry in Prairie County, runs through Baker, and exits into North Dakota. The line is electrically powered and provides only freight service to the county. A branch freight line of the main southern Montana route of the Burlington-Northern Railroad extends from Wibaux to the community of Ollie in the northeast part of the county. The needs for the remainder of the county are served by trucking firms.

There are no commercial airports in Fallon County. A 3,500 foot paved strip is, however, located at Baker where minimum services are available. There are also two additional air strips which were not built to normal dimensional standards and require special techniques and procedures to use. These air strips are not intended for full public access. Daily air service and connections to nation wide airlines are available in nearby Glendive.

Electrical power to the county is supplied from several sources. The Montana-Dakota Utilities Company has transmission lines which connect Baker with Glendive to the north and with Bowman, North Dakota to the east. A line also continues south from Baker to the Cedar Creek Gas field. The southern part of the county is supplied by the Southeast Electric Cooperative in Ekalaka, and the northern part receives power from the Goldenwest Electric Cooperative in Wibaux. Both cooperatives receive power from the Upper Missouri G & T Electric Cooperative in Sidney.

Since major power producing centers and relay stations are usually located at widely separated points and provide power service to large areas, Map 2 shows the major power grid system for the entire State of Montana. Major gas transmission lines are also shown.

Telephone service is provided by two separate companies. The largest area, which includes the northwestern and southeastern parts of the county, is served by the Mid-Rivers Telephone Cooperative. The Baker area and that portion extending to the southwest corner of the county are served by Mountain States Telephone.

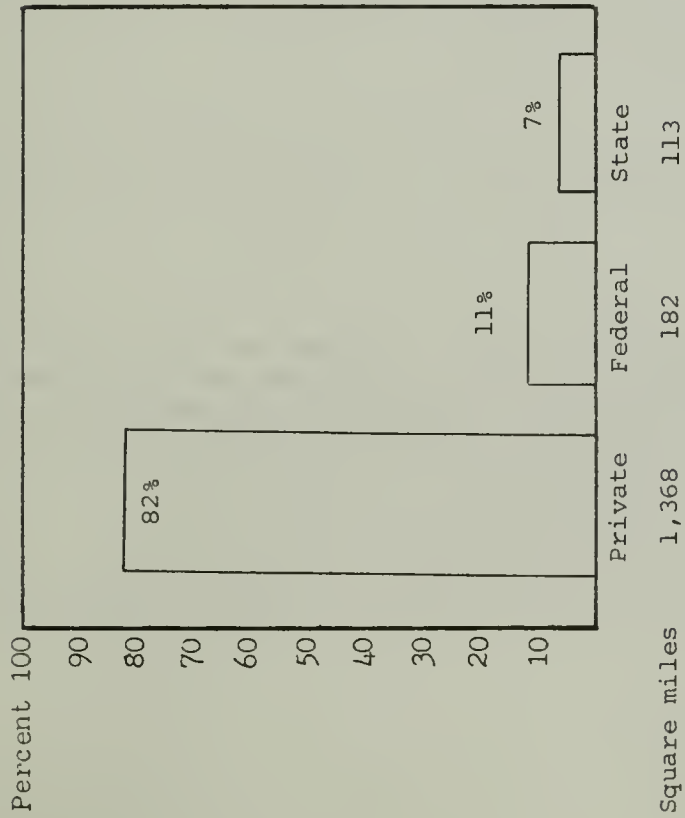
Land Ownership and Use

As seen in Chart 1, there are three ownership categories in the county. Private ownership is the largest and accounts for eighty two percent of the total. Land under federal ownership represents just more than one out of every ten acres while the state claims the remaining seven percent.

The land use pattern generally reflects the physical characteristics of the county, and ninety three percent of all lands are in agricultural use, thus reflecting the suitability of the land for cattle grazing. The remaining seven percent consists of non agricultural uses which include water surface area and land used for townsites and transportation routes.

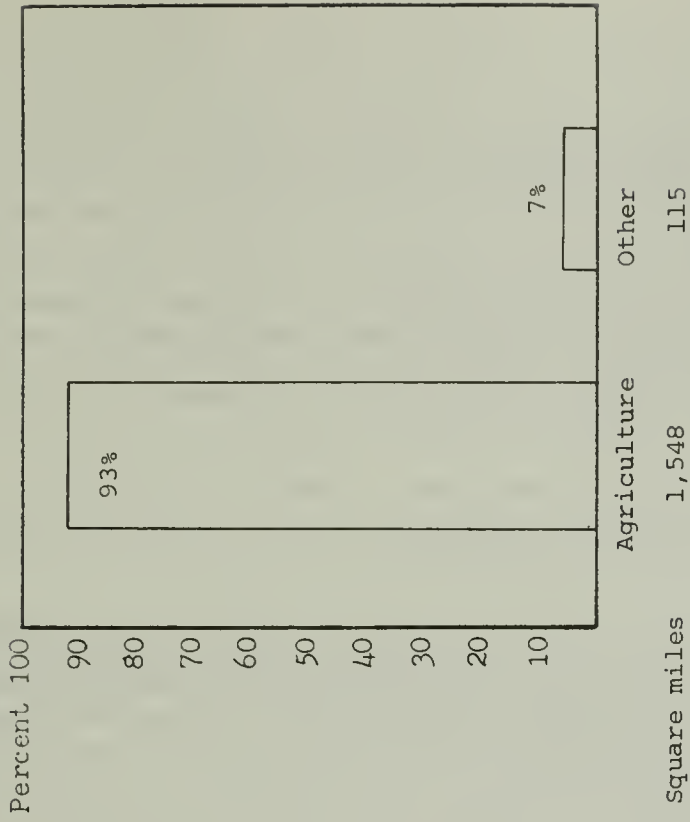
CHART 1

Land Ownership
Fallon County



Source: The Montana Almanac, 1959-60

CHART 2
Land Use
Fallon County



Natural Resources

Petroleum, sand and gravel, natural gas, stone, and coal are the important natural resources of the county. Existing petroleum drilling operations are located in the Cedar Creek, Cabin Creek, Piennel, Lookout Butte, Cupton, and Wills Creek South Fields. In 1968 seven new oil wells were drilled; four, however, were dry. In 1969 and 1970 exploratory efforts near Cupton Field yielded two more producing oil wells.

The demand for sand, gravel, and stone stems from local highway and railroad construction and maintenance needs, and the amount of the resources produced depends on the scale of building activities in the area. Other counties normally produce their own materials of this type, thus the export demand is limited.

The supply of natural gas in the county is good, and Cedar Creek Field is the second ranked producer in Montana. Cabin Creek and Plevna Creek Fields also supply this resource.

Coal bearing lands cover 1,383 square miles, or eighty three percent of the county. The United States Department of the Interior estimates there are 2,544,000,000 short tons of coal, mainly lignite, in the county representing one percent of all coal in Montana. The deposits are part of the Fort Union Region coal area.

Some of the finest pronghorn antelope hunting in the nation can be found within the county area. Excellent whitetail and mule deer hunting is also available along with varieties of upland game birds. The area is noted for its fine turkey hunting. The angler can choose from the many varieties of game fish such as rainbow trout, northern and walleye pike, bluegill, and bass.

The recreation potential of the county has not yet fully developed and, in the future careful planning of the recreation resource will serve to enhance the local economy.

Soils

Soils in the county are generally of the range grass and field crop supporting type. Almost half of all agricultural activities were in grain production and just more than one third in livestock production. Forest type soils are in small quantity and generally located in the higher altitudes in the southern portion of the county.

Soils data is covered in more detail later in this report.

Water

Surface water is not in abundance in Fallon County. O'Fallon Creek is the major drainage while Beaver Creek provides minor drainage. O'Fallon Creek originates from drainage in the Custer National Forest in Carter County and empties into the Yellowstone River east of Terry; the creek travels through the extreme western portion of the county on a northerly course. Beaver Creek originates just south of Ollie then flows northerly into Wibaux County before continuing into North Dakota.

Water resources are covered in detail later in this report.

THE PEOPLE

Population

For analytical and projective purposes, it is necessary to study the population history of Fallon County to find out what has happened and what is going to happen. Chart 3 graphically shows the growth of the county as compared with that for Montana and indicates the future growth for both.

The number of persons in Fallon County is lower than that recorded fifty years ago. The population has generally been decreasing since that time with few exceptions. The estimated 1970 population is eighty eight percent of the 1920 figure, and the projected 1990 population drops to eighty four percent of the earlier number.

The county was classified as a rural area in 1960 containing no urban areas and being located neither in nor near a major aggregate of urban population. Table 1 indicates the population changes for the urban, farm, and rural non farm areas of the county. The urban population increased between 1950 and 1960 while the number of persons in the rural areas declined. All rural losses occurred within farming areas while the rural non farm segment increased. During the past ten years this pattern again occurred in the county. The farm population declined while the number of persons in the rural non farm and the urban areas increased. Over the twenty year reporting period the urban population has increased as a percent of the total representing over half of all persons in 1950 and moving to two thirds in 1960; the present estimate is sixty eight percent. During the same period the number of farm persons dropped from forty one percent to twenty five percent, and the rural non farm group moved from four percent to seven percent.

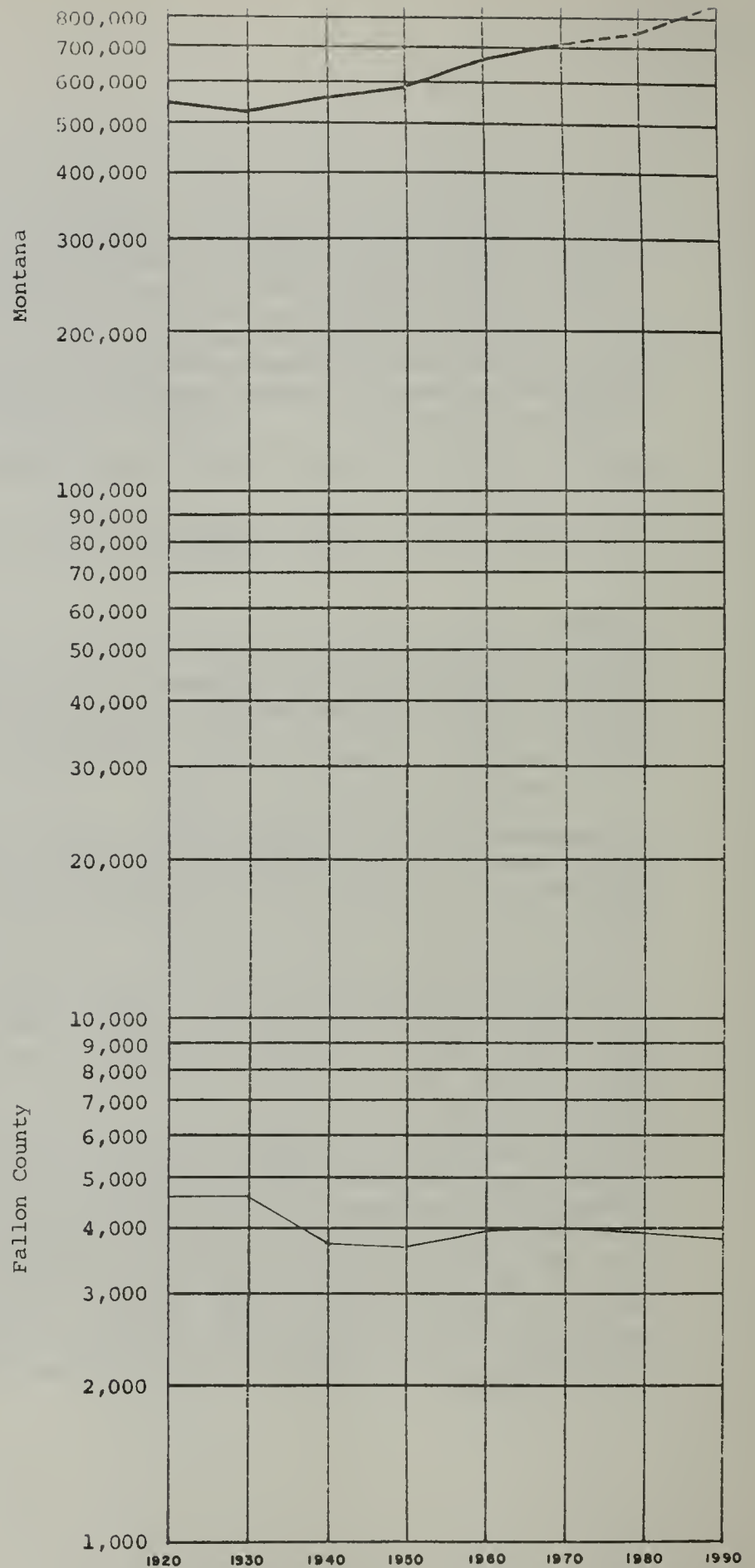
CHART 3

COMPARATIVE
POPULATION
TRENDS

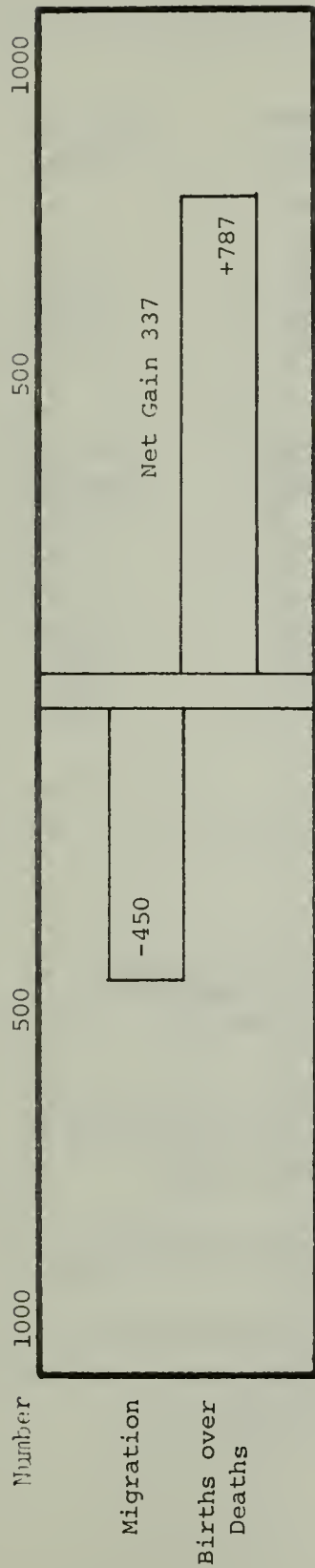
Fallon County
and Montana

Sources:

1. U.S. Census of
Population
2. Intermountain
Planners, Inc.



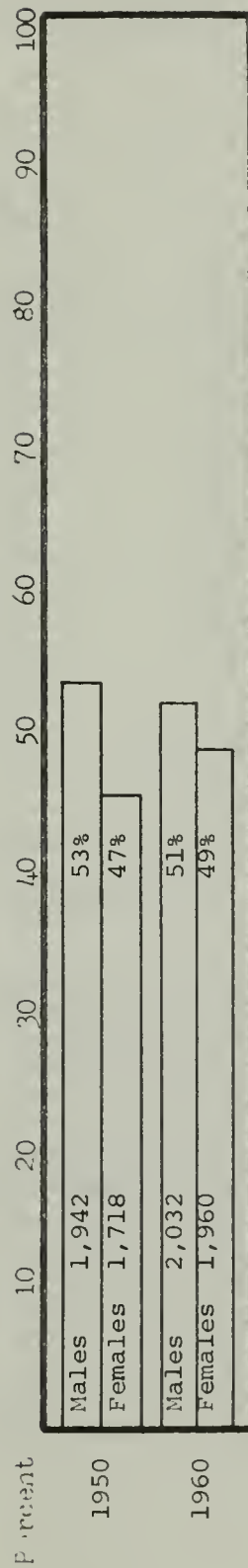
Population Change Fallon County 1950 - 1960



Source: Net Migration of Population, 1950-1960 by Age, Sex, and Color,
U. S. Department of Agriculture

CHART 5

Population by Sex Fallon County 1950 - 1960



Source: U. S. Census of Population, 1950-1960

TABLE 1

Urban-Rural Population Changes for Fallon County

1950-1970

	<u>1950</u>	<u>1960</u>	<u>Changes</u> <u>Number</u>	<u>1950-1960</u> <u>Percent</u>
Total	3,660	3,997	+337	+ 9.2
Urban				
(Inc. Towns)	2,019	2,628	+609	+30.2
Rural	1,641	1,369	-272	-16.6
Farm	1,487	1,203	-284	-19.1
Non Farm	154	166	+ 12	+ 7.8

	<u>1960</u>	<u>1970</u>	<u>Changes</u> <u>Number</u>	<u>1960-1970</u> <u>Percent</u>
Total	3,997	4,000	+ 3	+ 0.1
Urban				
(Inc. Towns)	2,628	2,700	+ 72	+ 2.3
Rural	1,369	1,300	- 69	- 5.0
Farm	1,203	1,000	-203	-16.9
Non Farm	166	300	+134	+80.7

Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

During the period from 1950 to 1960 the population of the county increased by 337 persons. The gain is a result of an excess of 787 births over deaths and a net migration loss of 450 persons.

The 1950 to 1960 change in sex composition is shown in Chart 5. As indicated, a centralizing trend occurred over the ten year period resulting in a slight preponderance of males over females. The ratio is expected to remain stable throughout the planning period.

The age distribution by sex for 1950 and 1960 is shown in Table 2. Increases generally occurred within the younger and older age groups.

Baker and Plevna are the only towns covered in this report. The

community of Willard was also studied but because of insufficient population and development was not included within the scope of this study.

TABLE 2

Age & Sex Composition of Fallon County

<u>Age Group</u>	<u>1950</u>		<u>1960</u>	
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
Under 5	235	228	276	282
5-14	347	349	468	458
15-19	153	139	133	135
20-24	170	118	108	123
25-34	291	251	281	230
35-44	247	219	250	242
45-54	162	135	218	195
55-64	168	160	121	123
65-74	126	87	109	125
75 +	43	32	89	51
Tota	_____	_____	_____	_____
Total	1,942	1,718	2,032	1,960

Source: U. S. Census of Population, 1950-1960

TABLE 3

Population Forecast for Towns and Communities

Fallon County

	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1990</u>
Baker	1,772	2,365	2,500	2,550	2,500	2,700
Plevna	247	263	200	190	175	150

Sources: 1. U. S. Census of Population, 1950-1960
2. Intermountain Planners, Inc.

The population of Baker will increase by almost eight percent over the next twenty years. The growth will create a need for approximately sixty additional dwelling units, and the added development is expected to occur in the east and southwesterly portions of the community.

The population figures reflect only those factors and trends for which information is available. New technological advances, new industries, or other unforeseen events may alter these projections. If such an event occurs, the areas affected should be examined in light of the new conditions.

Housing

There were 1,288 housing units in Fallon County in 1960. Chart 6 indicates that only one fourth of all units were represented by farms; the remainder accounted for all the non farm homes. Since the county lacked any recognizable urban center in 1960, there was not any urban classification of homes as found elsewhere in Montana. The

HOUSING Fallon County 1960

Chart 6
Housing Classification

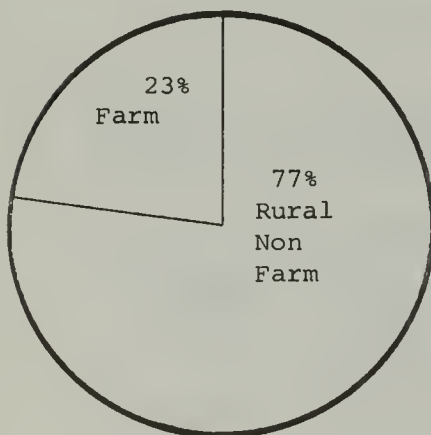


Chart 7
Housing Tenure

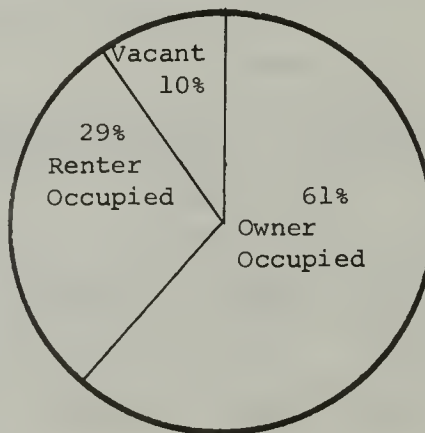
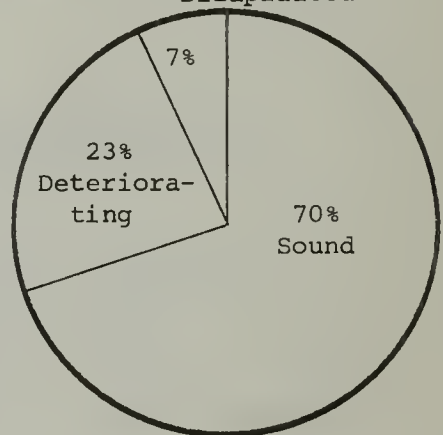


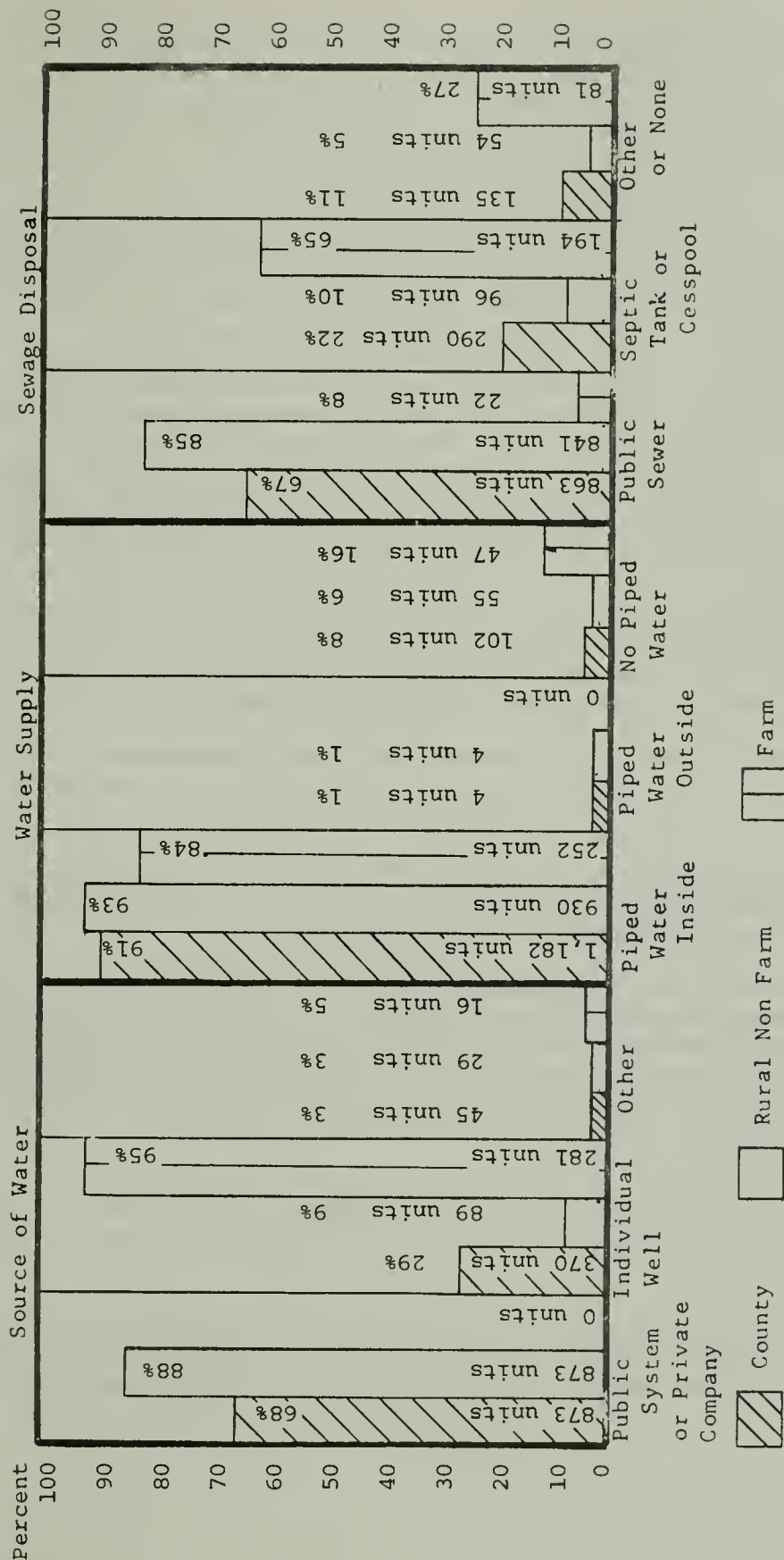
Chart 8
Housing Condition
Dilapidated



Source: U. S. Census of Housing, 1960

CHART 9

Sewer and Water
Fallon County 1960



Source: U. S. Census of Housing, 1960

median housing unit size was 4.50 rooms per unit, and the median household size per occupied unit was 3.43 persons. Almost two thirds of all units were owner occupied while twenty nine percent were used for rental purposes. Chart 7 indicates that ten percent were vacant. The 1960 condition of housing is shown in Chart 8. Seven percent needed replacing while twenty three percent were in need of repair. The remainder were classified as sound.

The 1960 status of housing is shown in Chart 9. The data reflects the source of water, water supply, and method of sewage disposal. For geographical reference, the status is shown for Fallon County as a whole and for the farm and rural non farm areas.

More than two thirds of all housing units were served by either a public water system or by a private company. Those served included eighty eight percent of the rural non farm homes and none of the farms. Individual wells generally supplied water in the farming areas. Ninety five percent of all farms received water from that source as did nine percent of the homes in the rural non farm areas. Only three percent of the homes obtained water from still another source.

Almost all homes had piped water in 1960. Eight percent of all homes, which included six percent of the rural non farm farms and sixteen percent of the farms, did not have piped water.

Over two thirds of all housing units were connected to a public sewer in 1960. Those in this group included eighty five percent of all homes in the rural non farm areas and eight percent of the farms.

About two thirds of the farms and ten percent of the rural non farm units used either septic tanks or cesspools. Eleven percent used still another method for sewage disposal.

The housing data indicates that about two thirds of the rural non farm homes were served by a public water and sewer system. The majority of all homes in this category are located within the town of Baker. This results in most of the rural non farm homes outside of Baker being without the same facilities. Efforts need to be directed towards solving their deficiencies.

THE ECONOMY

Labor

People have a direct relationship on the economy of an area because of their role as both producers and consumers of goods and services.

The following economic analysis of Fallon County is concerned primarily with the total economic spectrum and how it may affect the future of the area. Changing economic conditions can have either a good or a bad effect in terms of population growth, ability to provide for public improvements, or in determining the general overall living environment.

Employment rose by six percent in the county between 1950 and 1960 while the population increased by nine percent. Employment in the state increased by six percent during the same period.

Past employment change by major industry groups is shown in Chart 10. The discovery of oil in 1951 resulted in a growing economy in spite of a one third loss in agricultural needs. This growth was concurrent with a sharp decline in farm numbers and a moderate reduction in the number of rural farm persons. A marked gain in the rural non farm category elevated the total population significantly above the 1950 level. Expanded crude oil mining operations and a boost in construction were of particular note and were augmented by additions in trade, services and finance, and manufacturing. One third of the non agricultural positions were occupied by women in 1960. The female unemployment ratio, however, slightly exceeded that of males

Full convenience shopping and service facilities are located in Baker, but needs beyond those offered on the local level must be met elsewhere. The county lies within the Miles City service area where complete shopping facilities are available. The reliance of the county on other areas for goods and services is seen in the small number of persons engaged in the trade, and the services and finance industry groups. Over one third of all service and finance employment in 1960 was in education while only six percent were represented by professional services. Over one third of the persons employed in the trade group were employed in either restaurants or bars while just under one half represented retail trade.

Percentages for employment by industry groups in Table 4 give an insight into local employment characteristics. The table shows the relative weight of each industry group and offers a comparison with that existing in 1960 for the State of Montana and the United States.

Almost one third of the employed labor force were in agriculture even though the group declined in total numbers by over a third in the previous ten years. The county rate of agricultural employment in

TABLE 4

Percent of Total Employment by Industry Groups

Fallon County, Montana and United States

1960

	<u>Fallon County</u>	<u>Montana</u>	<u>United States</u>
Agriculture	32	17	11
Forestry and			
Fisheries	0	1	1
Mining	8	3	1
Construction	9	7	5
Manufacturing	3	10	27
Transportation			
and Utilities	6	9	7
Trade	18	21	19
Service and			
Finance	21	26	16
Government	3	6	13
Total	100	100	100

Source: U. S. Census of Population, 1960

1960 was almost double that for the state and three times that for the nation.

The most unusual employment rate occurred in the mining industry group. All oil exploration employment is included in this category which explains the above average rate.

The remaining rates are generally within the range noted throughout Montana, particularly in agricultural counties.

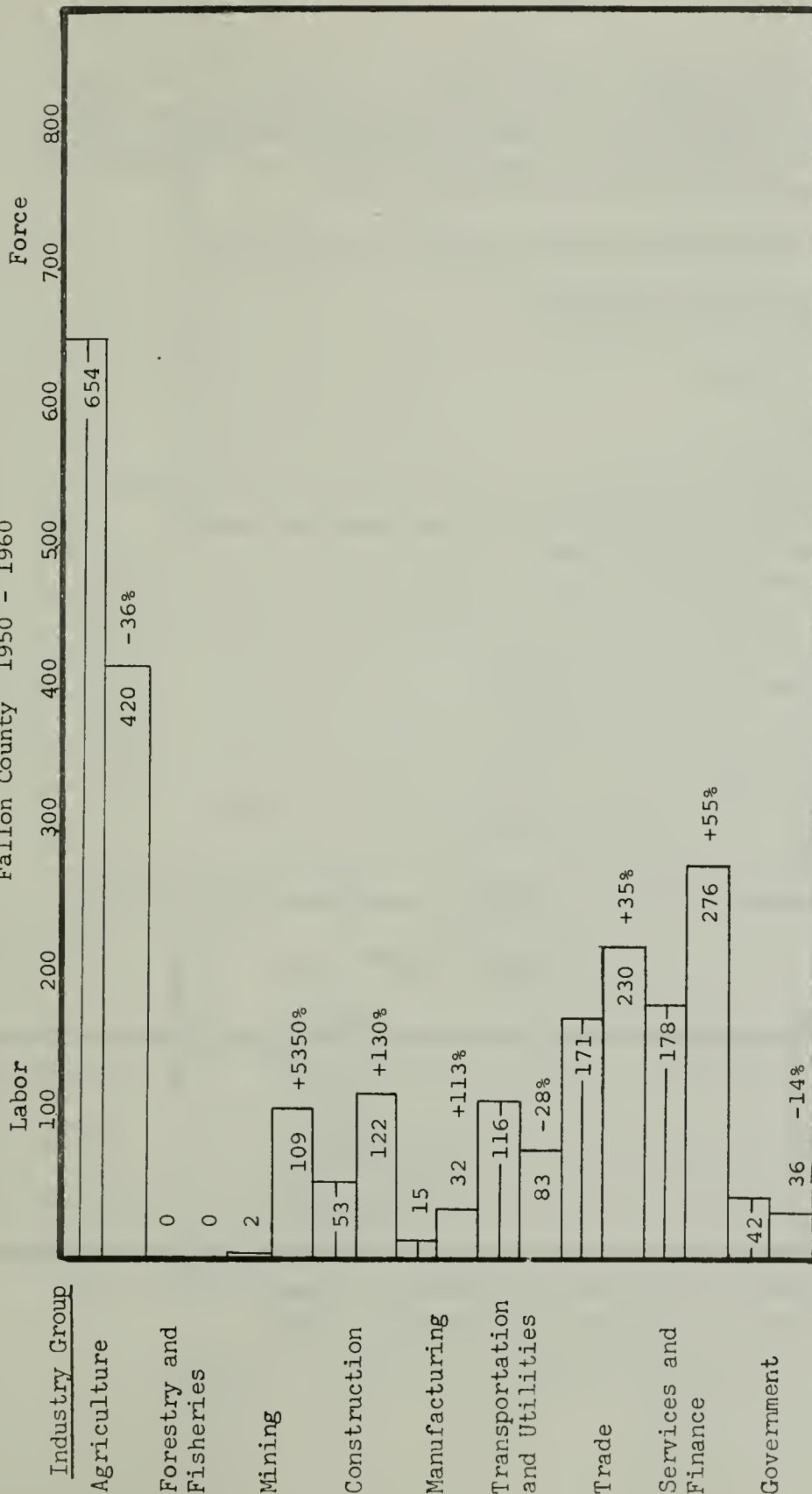
The Employment Security Commission of Montana publishes employment figures on an annual basis. The 1969 data indicate a general employment decrease in most categories. A rise in numbers is noted in the mining group which increased by eleven percent over the 1960 figure.

Present indicators point to a sustained future economic growth for Fallon County. Oil exploration and development should increase over the 1960 figure.

CHART 10

Employment Change by Major Industry Group

Fallon County 1950 - 1960



1950 Total Employment 1,253*

1960 Total Employment 1,336*

*Includes Some Industries Not Reported

Source: U. S. Census of Population, 1950-1960

Agriculture

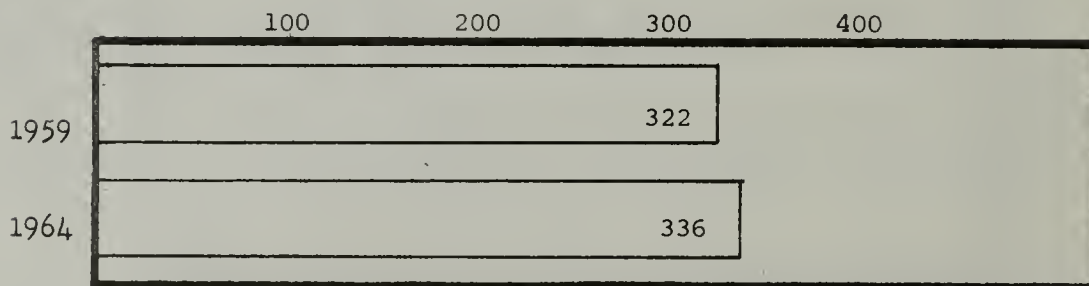
The United States Census defines a farm as a place having at least ten acres of land devoted to agriculture and selling at least fifty dollars worth of agricultural products annually. According to Chart 11, there were 336 farms in Fallon County in the above category in 1964, four percent more than there were in 1959.

The 1964 classification of farms by type was as follows:

Field crop farms other than vegetables, nuts, and fruit	149
Cash grain	149
Poultry farms	3
Dairy farms	3
Livestock farms other than poultry and dairy	131
General farms	13
Miscellaneous and unclassified	37
Total	336

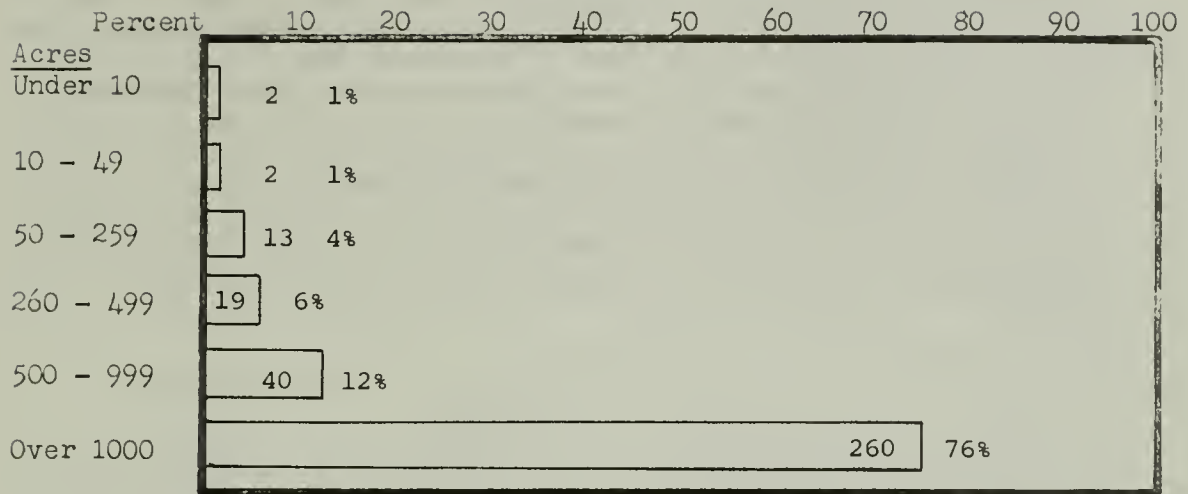
CHART 11

Number of Farms
Fallon County 1959 - 1964



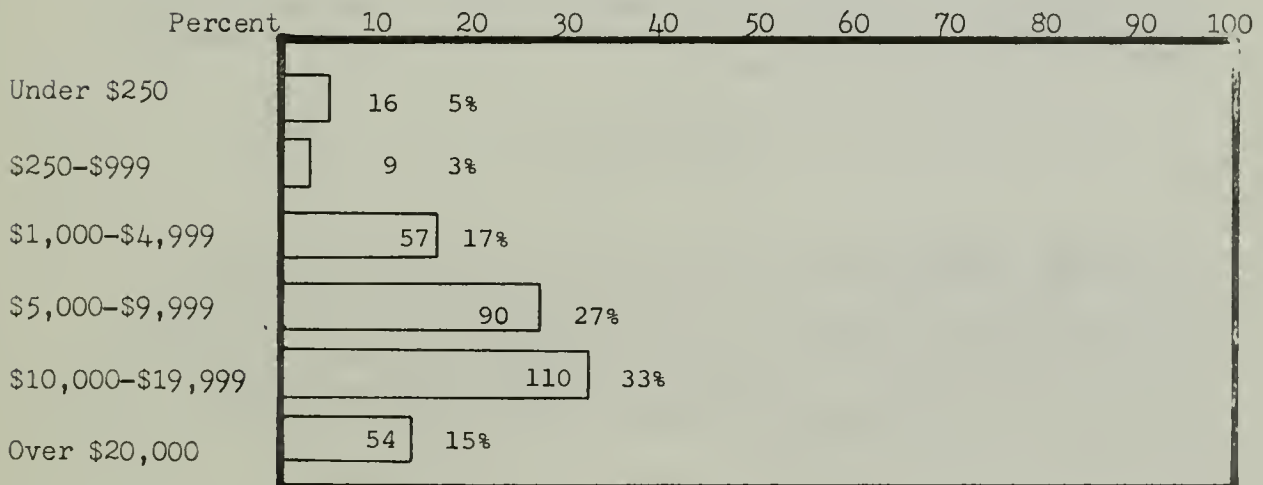
Source: U. S. Census of Agriculture, 1964

CHART 12
Farms by Size
Fallon County 1964



Source: U. S. Census of Agriculture, 1964

CHART 13
Number of Farms by Value of Farm Products Sold
Fallon County 1964



Source: U. S. Census of Agriculture, 1964

Of the total number of farms, twenty three were classified as part time, and nine were classified as being operated by semi retired persons.

Just less than half of all farms produced cash grain crops in 1964 while just over one third raised livestock. The average size farm in the county was 2,950 acres. Chart 12 indicates that three fourths of all farms were in excess of one thousand acres. Only one farm in eight was under five hundred acres in size.

The value of products sold by the number of farms is shown in Chart 13. Almost half of the farms received more than \$10,000 for products sold while fifteen percent received over \$20,000. At the same time, one farm in four reported gross agricultural receipts of under \$5,000.

Cash receipts for the county from 1964 to 1967 are as follows:

<u>Year</u>	<u>Livestock</u>	<u>Crops</u>	<u>Total</u>
1964	\$2,570,000	\$2,199,100	\$4,769,100
1965	\$2,970,900	\$1,692,000	\$4,662,900
1966	\$3,745,800	\$1,937,600	\$5,683,400
1967	\$3,508,800	\$2,697,200	\$6,206,000

In 1964 the sale of livestock products accounted for just more than half of all agricultural products sold. By 1966 this category climbed to sixty six percent of the total but declined to fifty seven percent in 1967. The data shows the importance of livestock in the agricultural economy.

Agriculture will continue to intensify throughout the twenty year planning period. Statistics indicate the growing importance of livestock products, which may result in an increased number of farms turning to that type of production.

THE GOVERNMENT

Before any meaningful consideration can be given to major capital improvement projects, it is necessary to study the governmental organizations in Fallon County and analyze their economic structure. At present there are three separate, local governmental units in the county involved within the scope of the water and sewer study. Included are the incorporated cities of Baker and Plevna and the government of Fallon County.

A Board of County Commissioners presided over by a chairman governs the county. The incorporated municipalities are governed by a mayor council form of government.

In financing capital improvement projects, the incorporated municipalities have power to bond and raise the necessary monies for funding projects. The unincorporated small towns do not have similar power and, therefore, must rely on financing projects through the county government.

Table 5 indicates the financial condition of each unit of government in 1969.

TABLE 5

Financial Status of County Government and Incorporated Cities

Fallon County 1969*

	<u>Revenue</u>	<u>Expenditures</u>	<u>Assessed Valuation</u>
Fallon County	\$3,157,460.97	\$2,987,986.18	\$35,830,347.00
Baker	293,290.05	310,838.65	6,296,844.00
Plevna	16,280.93	13,826.43	371,905.00

* There are several methods presently available to communities for financing water and sewer systems:

1. Incorporated Cities and Towns may use Municipal Bonds, Municipal Revenue Bonds, and Special Improvement District Bonds.
2. Unincorporated Towns may use Rural Special Improvement District Bonds and County Water and Sewer District Bonds.
3. Incorporated Cities and Towns and adjacent unincorporated areas may use Metropolitan Sewer District Bonds.

Source: Information received from each governmental unit

THE WATER RESOURCES

General

The water resources of any area are one of its most important assets. Montana is fortunate in that water is in abundant supply over much of the state. This is especially true in the mountain areas and along the major drainages. Water is essential for many human needs with individual consumption and sanitation being foremost. Industrial and agricultural uses of water are perhaps next most important. The recreational use of water has also become a significant factor in modern day living.

In his use of this resource, man in the past has polluted much of the available fresh water and degraded it to the point where it is unfit for many or all uses. Careful planning for the efficient use of water resources can avert inconveniences caused by pollution.

Water resources, therefore, are an important consideration in the comprehensive planning for community water and sewer systems. In the following portion of this report the existing water resources of the planning area will be briefly reviewed. The discussion will be specifically concerned with the occurrence and availability of both surface and ground water. Also important, and included in Appendix I, are the specific laws and policies of the State of Montana concerning surface and ground-water resources. "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" adopted by the State Department of Health are discussed in detail. Table A in Appendix I outlines present day water quality standards as set forth by the United States Health Service.

Surface-Water Resources

Fallon County has an extensive drainage system which has primary characteristics of plains topography. Drainage may be found flowing in almost any direction; however, the main drainage pattern is toward the northwest. Drainage from the southeastern portion of the county, however, is toward the northeast.

Elevation differences are not excessive, and the complex surface drainage system is attributed to the hilly topography. In general, the highest elevations, over 3,500 feet above sea level, occur in the southern portion of the county. The lowest elevation, just over 2,500 feet above sea level, occurs north of Plevna in extreme northwestern Fallon County.

The major drainage features of Fallon County are O'Fallon Creek, Sandstone Creek, Little Beaver Creek, and Box Elder Creek. O'Fallon Creek drains the eastern county area and leaves the county northeast of Plevna. O'Fallon Creek continues on through Custer and Prairie Counties to its confluence with the Yellowstone River near Fallon. Sandstone Creek flows northwest across the central county area through Baker and Plevna to its confluence with O'Fallon Creek near Ismay in Custer County. The headwaters of Little Beaver Creek are in Carter County near Ekalaka. Little Beaver Creek flows northeast across southern Fallon County before entering North Dakota. Box Elder Creek also heads in Carter County, and it flows through the extreme southeastern corner of Fallon County just crossing the corner of South Dakota. Little Beaver Creek and Box Elder Creek are tributaries of the Little Missouri River.

The above streams provide a yearlong source of water for irrigation, livestock, and domestic needs. Little Beaver Creek and Box Elder Creek have gaging stations installed by the United States Geological Survey (U. S. G. S) where flow measurements are taken and recorded at regular intervals. Table 6 includes available data on the drainage area, discharge, and runoff for the Little Beaver Creek station near Marmarth, North Dakota and Box Elder Creek near Webster in southern Fallon County.

Many small reservoirs add significantly to the agricultural and especially the irrigational use of water in the county. As is the case in most counties in Montana, there are no records for small reservoirs published by the U. S. G. S. The Montana Water Resources Board, however, has compiled and published a list of reservoirs which store fifty acre feet or more of water. Where information was available, data for privately owned dams and reservoirs was also included. Information on the irrigation facilities of Fallon County can be found in the "Water Resources Survey" published by the Montana Water Resources Board in June, 1960. This publication and other information on the use of surface water in Fallon County can be obtained from the Water Resources Board in Helena, Montana.

The climate does not have the extreme variable pattern common to the more mountainous western counties in Montana. Precipitation averages vary across the county with the highest averages being recorded at the higher elevations. For instance, annual precipitation averages at Plevna and Baker in central Fallon County are 13.39 inches and 13.31 inches for over thirty years of record. Precipitation averages at lower elevations in the county range between eleven and twelve inches per year. It is important to note, however, that the majority of the annual precipitation falls during the growing season of April through September.

TABLE 6

Stream Gaging Stations

Stream	Gaging Sta. Location	Drainage Area (sq mi)	Notes	Discharge (cfs)			Years Averaged	Runoff-(1000 Acre-Ft)		
				Max.	Date	Min. Date		Max.	Date	Min. Date
1. Box Elder Creek	Near Webster	1092	1	7340	5/9/67	No Flow	At Times	123.2	1967	3.31 1961
2. Little Beaver Creek	Near Marmarth No. Dak.	587		12,700	4/6/52	No Flow	At Times	84.62	1952	2.28 1961

Source: U. S. G. S. Water Supply Papers and
"Surface Water Records of Montana"

Note: 1. Some irrigation diversions occur above this station

In general, precipitation occurs as heavy rain in the spring months of April through June, intermittent showers throughout the summer and early fall months, and as snowfall during the winter months. The snowfall is generally light and does not tend to remain on the ground for long periods of time. Winter warming spells producing thawing temperatures throughout the county are not uncommon.

The use of surface water is widespread for agricultural and recreational purposes. The irrigation summary of Fallon County included in the "Water Resources Survey" published by the Water Resources Board in 1960 indicates that at that time over 2,800 acres were being irrigated in Fallon County. As is the case in most counties in eastern Montana, the potential exists for the irrigation of many additional acres. Also important is the use of surface water for recreational purposes. The ponds, reservoirs, and streams in the county are ideal habitat for fish and waterfowl and draw many sportsmen to the area each year.

Water Use Classifications

The Water Pollution Control Council has classified the streams and drainages in Montana according to the water use classification definitions shown in Appendix I. The streams and drainages of Fallon County and surrounding areas are classified as follows:

Yellowstone River drainage from the Billings water supply intake to the North Dakota line except the tributaries listed below:	B-D ₃
Pryor Creek drainage	B-D ₁
Big Horn drainage above but excluding William's Coulee near Hardin	B-D ₁
Big Horn drainage from and including William's Coulee to the Yellowstone River except the Little Big Horn listed below:	B-D ₂
Little Big Horn drainage above and including Lodge Grass Creek near Lodge Grass	B-D ₁
Remainder of the Little Big Horn drainage	B-D ₂

Tongue River (mainstem) from Tongue River Reservoir to but excluding Prairie Dog Coulee	B-D ₂
Remainder of the Tongue River drainage	B-D ₃
Fox Creek drainage near Sidney	B-D ₂

Little Missouri and Belle Fourche drainages:

All waters	B-D ₃
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Ground-Water Resources

Ground water is used extensively in Fallon County for stock and domestic purposes, and in most areas the only source of water is from wells. As of January 1970, the Montana Bureau of Mines and Geology had 746 appropriations for wells and 228 appropriations for springs on file for Fallon County. A total of 453 wells were appropriated for stock use, thirty six for domestic use, 224 for both stock and domestic use, and thirty three for a variety of other uses. A total of 114 springs were appropriated for stock use, two for domestic use, two for irrigation, and one for public supply; the uses of 109 springs were not reported. Baker obtains water for municipal use from four drilled wells, and the town of Plevna obtains municipal water from two drilled wells. (See Table 7 for chemical analyses of these water supplies.)

Technical reports that discuss ground water in parts of Fallon County are as follows: Taylor, O. James, 1965, Ground-water resources along Cedar Creek anticline in eastern Montana: Montana Bureau of Mines and Geology Mem. 40, 99 p.; Peterson, Ross K., 1962, Ground-water study, Baker area: Prepared for the City of Baker, Montana, 74 p. (unpublished).

The geologic history of Fallon County includes long periods of sedimentation with only minor interruption by uplift and erosion until the end of Cretaceous time (about 65 million years ago). At the end of Cretaceous time, a period of major structural upheaval uplifted a structure called the Cedar Creek anticline, which trends north-westerly across the northeastern half of Fallon County. Subsequent erosion has exposed some older geologic formations along the crest of the anticline. After the period of major structural upheaval and erosion, sedimentation resumed and has continued to the present time.

Geologic formations of importance to the water resources of Fallon County include alluvium of Recent age (less than twenty thousand years

old); and the Hell Creek, Fox Hills, and Pierre Formations of Cretaceous age (65 to 135 million years old). There are many thousands of feet of sediments that lie below the Pierre Formation, and some are known aquifers (water yielding materials), but these older formations are generally too deep lying in Fallon County to be of economical importance to the water resources of the county.

TABLE 7

Chemical Analysis of Municipal Water Supplies

(All Figures in Milligrams per Liter)*

<u>City or Town</u>	<u>Baker</u>	<u>Baker</u>	<u>Baker</u>	<u>Baker</u>	<u>Plevna</u>	<u>Plevna</u>
Source	Well	Well	Well	Well	Railroad	School
	#1	#3	#4	#6	Well	Well
Date	12/66	12/66	12/66	12/66	11/66	11/66
Total Solids	870	470	870	490	690	560
Hardness	0	25	0	0	0	0
Ca	0	8	0	0	0	0
Mg	0	1	0	0	0	0
Na+K	328	179	343	190	280	252
CO ₃	12	30	18	0	39	21
NCO ₃	537	262	552	323	474	433
CO ₄	220	127	238	132	105	129
Cl	15	10	11	7	36	15
NO ₃	0.9	0.0	1.3	0.0	0.0	0.0
F	0.6	0.5	0.6	0.3	0.8	0.8
Fe	0.15	0.07	0.00	0.12	0.08	0.11
As	0.00	0.00	0.00	0.00	-	-
Pb	0.03	0.00	0.00	0.00	0.00	0.00
Cu	0.15	0.00	0.00	0.00	0.15	0.00
Zn	-	-	-	-	-	-

* See Appendix I, Table A, for accepted water quality standards

Source: State Department of Health, Helena, Montana

Recent alluvium is present along stream beds and some coulee bottoms in Fallon County and consists of unconsolidated mixtures of clay, silt, sand, and gravel. Alluvium in Fallon County contains a relatively high percentage of fine grained material. As a result,

generally only small quantities of water can be obtained, and this water may be poor in quality. Locally, however, enough water of fair quality can be obtained for stock and domestic use. The alluvium would be most favorable as a source of ground water where it is present along the largest and most active streams in the county.

The Fort Union Formation of Tertiary age is an important source of ground water for stock and domestic use in Fallon County. The Fort Union Formation is exposed at the ground surface on the west side of the Cedar Creek anticline and in the northeastern part of Fallon County along the east side of the anticline. The Fort Union attains a maximum thickness of five hundred to six hundred feet in the county and consists of interlayered beds of shale, siltstone, lignite coal, some limestone, and discontinuous sandstones. Many relatively shallow water wells in Fallon County produce water from sandstone and coal beds in the Fort Union. Usually, adequate supplies of good to fair quality water for stock and domestic use can be obtained from the sandstone and coal beds. Sandstones and coal zones that are exposed in the hills of the county are likely to be drained. Water from the Fort Union is usually somewhat harder than water from underlying formations.

The Hell Creek Formation of Cretaceous age, which lies below the Fort Union, consists of about two hundred feet of nonmarine and brackish water sandstone, shale, mudstone, and siltstone. The lower one hundred feet of the Hell Creek commonly is a light brown to green, medium to coarse grained, crossbedded sandstone. The Hell Creek is exposed at the ground surface in a narrow band along the west flank of the Cedar Creek anticline and in a broader band, about a township wide, on the east side of the anticline. Sandstones of the Hell Creek will normally yield abundant quantities of soft water for stock and domestic use. Locally the water may be highly mineralized.

The Fox Hills Formation of Cretaceous age lies below the Hell Creek. The Fox Hills Formation is exposed at the ground surface as two narrow parallel bands along the crest of the Cedar Creek anticline. The Fox Hills consists of one hundred to 150 feet of marine and brackish water deposits of cross bedded sandstone, siltstone, and shale. The upper part of the Fox Hills consists of about forty feet of light gray sandstone and is called the Colgate Sandstone Member. The sandstone at the base of the Hell Creek rests in contact with the Colgate Sandstone Member, and together these sandstones constitute a relatively thick and continuous aquifer. The lower, unnamed member consists of fine to medium grained, light brown, yellow brown, or light green sandstones interbedded with shale. Generally, adequate supplies of good to fair quality water for stock and domestic use can be obtained from the Colgate and from sandstones of the overlying Hell Creek Formation; consequently, drilling below the Colgate usually is

not necessary. Water obtained from the Hell Creek and Fox Hills is probably too highly mineralized for general irrigation use.

The Pierre Formation of Cretaceous age, which lies below the Fox Hills Formation, consists of 1,500 to two thousand feet of dark, dense, marine shale and sandstone. The Pierre is exposed at the ground surface along the crest of the Cedar Creek anticline and is not a good source of ground water in Fallon County. Sandstones in some horizons contain salt water, and natural gas is produced from another sandstone horizon. Water obtained from thin sandstone lenses in the Pierre would probably be small in quantity and poor to very poor in quality.

In summary, geologic formations of importance to the water resources of Fallon County include Recent alluvium; the Tertiary Fort Union Formation; and the Hell Creek, Fox Hills, and Pierre Formations of Cretaceous age. Sediments lying below the Pierre Formation are too deep lying in Fallon County to be of economical importance to the water resources of the county. The petroleum industry is using ground water for secondary recovery of oil (water flooding). This use will probably decline in the future. There does not appear to be sufficient amounts of suitable quality ground water for use in major irrigation projects. However, further detailed hydrogeological study will be required to accurately assess the ground-water resources of Fallon County and to assist the county in the proper and orderly development of its ground-water resources.

- Sources:
1. M. K. Botz, Montana Bureau of Mines and Geology, Butte, Montana, 1970
 2. State Department of Health, Helena, Montana
 3. U. S. G. S. Water Supply Papers and "Surface Water Records of Montana"
 4. "Water Resources Survey" Fallon County, Montana, Montana Water Resources Board, Helena, Montana, 1960

THE SOILS

General

General descriptions of soils in specific areas are useful in predicting the potential problems which might be encountered during private and public works construction. Fallon County has an

interesting and complex geologic history which has greatly influenced the soil structure of the area. The county is a portion of the plains area of eastern Montana, and physiographically it is characterized by rolling hills and benchlands dissected by a complex surface drainage system.

The soils of Fallon County were derived from parent materials originally located in the immediately adjacent area. The parent materials, commonly consisting of the sedimentary rocks such as sandstone, shale, and related rocks, were eroded, transported, and deposited by various processes. Thus, the soils resulting consist of stream deposits or alluvium and lake deposits or the alterations of these materials due to various conditions of climate, topography, and living organisms.

Soil Map

The Soil Conservation Service of the United States Department of Agriculture has prepared a general soil map for Fallon County. The map as presented by them is shown in this report as Map 4. In developing this map, the Soil Conservation Service made field studies and observations which resulted in the designation of eleven general soil areas. Each general soil area, as a rule, contains a few major and several minor soils. Soils within an area may differ greatly in short distances, and any one soil may occur in more than one area. Thus, the general soil map does not show the kind of soil at any particular point but shows specific patterns of soils.

The Soil Conservation Service is continuing to expand the detailed soil study of Fallon County. As additional information is gathered it will be available from the Soil Conservation Service office in Baker. Much of the detailed soil information gathered in the preparation of the general soil map is available at this time in the Baker office. It is recommended that all of the available soil information be consulted during the planning of proposed public works projects in Fallon County. Also, on site soil investigations should be performed.

The Soil Conservation Service preliminary draft descriptions of the eleven soil areas shown on the general soil map are presented as follows:

Soils of the Flood Plains and Terraces

1. These areas are dominated by nearly level to undulating, deep, well drained, calcareous, fine sandy loams, silty clay loams, and silty clays underlain by strata of sandy loam, silty loam and

silty clay; and deep, dense, strongly alkaline clays; on flood plains and terraces.

2. These areas are dominated by nearly level to undulating, deep, well drained, calcareous, fine sandy loams, loams and silt loams underlain by strata of sandy loam, and silt loam; on flood plains and terraces.

Soils of the Gently Sloping to Rolling Sedimentary Plains

3. These areas are dominated by undulating to rolling, well drained, dark colored loams and light colored, calcareous silt loams; underlain by silt loam sedimentary beds.

4. These areas are dominated by gently sloping to undulating, well drained soils that have dark colored loam and silt loam surface layers and loam and silty clay loam subsoil layers; underlain by calcareous silt loam and clay loam sedimentary beds.

5. These areas are dominated by gently sloping to rolling, well drained, moderately deep, dark colored fine sandy loams and deep, light colored loamy fine sands; underlain by soft sandstones.

Soils of the Undulating to Steep Sedimentary Plains

6. These areas are dominated by undulating to steep, light colored, calcareous silt loams, clay loams and silty clay loams underlain by silt loam, clay loam and silty clay loam sedimentary beds.

7. These areas are dominated by undulating soils in swales that have thin loam and silty clay loam surface layers and strongly alkaline and saline subsoil layers, underlain by strata of loam and silty clay loam; and strongly sloping to moderately steep soils on ridges that are calcareous clay loams and silty clay loams underlain by clay loam and silty clay loam sedimentary beds; and on most steep ridges are deep loam fine sands underlain by soft sandstone.

8. These areas are dominated by deep, loamy fine sands underlain by soft sandstone; calcareous clay loams and silty clay loams that are underlain by clay loam and silty clay loam sedimentary beds on steeply sloping ridges; and moderately deep, dark colored fine sandy loams underlain by soft sandstone in most swales.

Soils of the Steep to Very Steep and Broken Sedimentary Plains

9. These areas are dominated by steep to very steep, mainly calcareous clay loams and silty clay loams underlain by clay loam and silty clay loam sedimentary beds that outcrop in numerous large

broken and severely eroded areas; and deep, loamy fine sands underlain by soft sandstone on ridge tops.

10. These areas are dominated by steep to very steep silt loams, clay loams and silty clay loams underlain by silt loam, clay loam and silty clay loam sedimentary beds that outcrop in numerous severely eroded areas. In some places are small areas of reddish colored, shallow soils underlain by hard, fractured reddish colored shales that also outcrop on steep slopes.

Soils of the Clayey Shale Plains

11. These areas are dominated by undulating to very steep, shallow, dense clays that are underlain by fractured, gray claystone or clay shale that outcrops in numerous places on steep and very steep slopes.

Conclusions

The soils of Fallon County have generally been easy to deal with where domestic water wells and individual sewage drainfields have been constructed. The alluvium and other deposits have been found to be extremely variable in permeability, however, and this has had an effect on both the quantity of water available in shallow domestic wells and the successful operation of individual sewage drainfields. In many areas extensive clay and silt deposits require special care in the construction and operation of septic tank drainfields.

Construction of municipal water and sewer systems in the various soils of Fallon County has not been found to be difficult. Pipeline trench digging in the sands and clays is extremely easy while coarse alluvium or stream gravels slow operations somewhat. As indicated in the soil descriptions, some bedrock can be expected at normal water and sewer line installation depths. Detailed soil information should be obtained before project planning and construction cost estimating are begun.

Source: U. S. Department of Agriculture, Soil Conservation Service,
Miles City, Montana

COMMUNITY WATER SYSTEM FACILITIES

General

This comprehensive report covers the overall problems, existing or

projected, for Fallon County, Montana. The volume of data processed and evaluated and the intent of the report allow only a general analysis of any one system.

The intent of this report is to point out the general needs of each community with the objective that each community may in the future be provided with a safe and adequate water system. The general solutions to overall problems suggested in this report may have to be modified when detailed studies are made. These modifications may be in exact size of parts of a system or in some detailed design variation but will not detract from the overall value of the general information presented.

Basically, the demand for water from community systems is for domestic, fire fighting, and industrial uses. The demand for industrial water supply in small communities has not been extensive in Montana and in most cases will not control the design of community systems. sufficient water for fire fighting must be considered; however, economic feasibility will usually control the extent of such facilities. In most small communities a system with sufficient capacity to give high ratings for fire protection would require facilities considerably larger than necessary for domestic purposes. The community might be unable to finance such an improvement; the approach, therefore, has been to propose a system suitable for present domestic needs. These basic facilities can be expanded for more complete service and for higher fire ratings as it becomes economically feasible.

The domestic use of water has increased greatly in recent years. This is partially due to improved economic conditions which make it possible for families to acquire such water consuming appliances as dishwashers, waste disposal units, and automatic washing machines. Water use for beautifying property has also increased. The most essential condition is adequate, safe, and potable water for domestic purposes, and this has been the primary consideration in this study. See Appendix II for further comments on analysis criteria.

Basic Considerations

Communities studied in this comprehensive plan were those with a minimum of five potential users and a maximum population of 5,500. Each community within this category was visited at least once. During these visits the type of water facilities available was examined, and an evaluation of the facilities was made from the standpoint of fulfilling the needs of the residents.

The existing systems were found to be quite varied in their operation,

condition, and suitability for serving the needs of the users. The situation in each community was evaluated separately; however, some general classification of the various systems was possible. These are described briefly in the following paragraphs so that the general philosophy of the analysis can be shown.

1. In some communities the homes are quite widespread and few in number. Good water in adequate quantities can be found at reasonable depths, and for such situations private wells will provide a safe and suitable water system.

2. Many communities have had access to good water from private wells for many years. In some of these communities population is increasing, and the area is becoming more densely settled. As a result, tests for bacteriological quality of well water occasionally indicate that pollution is present. When this occurs, it is usually the beginning of a problem which will continue to worsen. Increasing population and a higher potential for contamination indicate the need for a safe community water facility. The system should be one which will serve the domestic needs of the present residents with provisions for improvements and expansion as needed.

3. Many communities have enjoyed a central water system for years but have not made annual improvements and replacements. This has resulted in overloaded and antiquated systems. Suggestions for immediate improvements which will fit into an overall replacement program are included in this report.

4. Some communities which have experienced a steady population growth are finding that their water systems are inadequate for present demands and will require enlargement. Population projections and economic trends are used to determine the need for improvements and also to justify the type and extent of proposed improvements.

Fallon County

The estimated 1970 population of Fallon County is four thousand. Approximately 2,700, or 67.5 percent, of these people are presently served by central water systems in Baker and Plevna, and the remainder are served by private facilities such as wells and springs. By 1990 about 2,850, or seventy five percent of the population, will have access to central water systems if the schedule of proposed improvements is followed. These figures are based on population projections which indicate an overall decrease in county population and an increase in the town population of Baker. It is expected that the remaining county population will live in outlying areas, and the homes will not be close enough together to make central systems feasible.

Baker

Existing System. The estimated 1970 population of Baker is 2,500, and population projections indicate that this town will increase in population throughout the planning period. The area is presently served by a central water system, the layout of which is shown on Map 5. Water for this system comes from five drilled wells all located west of the town. These wells range in depth from approximately 250 to five hundred feet and obtain water from the Fox Hills aquifer. The combined capacity of these wells is approximately seven hundred gallons per minute (gpm); the water pumped into the system is not treated in any manner. Storage for the system is provided by two, concrete, ground storage tanks with capacities of 100,000 gallons and 175,000 gallons respectively. These storage reservoirs are located adjacent to each other southwest of town. The condition of these tanks is good, and major repair or replacement is not anticipated in the near future. The distribution system is made up of four, six, and eight inch diameter pipe in good condition which supplies adequate flows of water at average pressures of sixty pounds per square inch (psi) throughout the town.

Based upon current population figures and the design criteria of this report, the Baker water system is presently providing the minimum required supply to handle the current population within the town limits. Predicted population increases and anticipated development outside of the town limits, however, will require that the present system be expanded in the near future.

Improvements Next Five to Ten Years. The 1975 population of Baker is expected to reach 2,550. It is proposed that the water supply be increased by 450 gpm during this period through the installation of two wells located as shown near the area of proposed new development on the east side of town. Additional detailed engineering study would be necessary to determine the feasibility of establishing wells of 225 gpm capacity in these locations.

Improvements by 1990. The 1990 population of Baker is expected to be 2,700. During this period one additional well with a capacity of 225 gpm should be established in the system. A well near the area of new development south of town should be constructed. Also, storage for the system should be increased by the installation of a 200,000 gallon ground storage tank which could be located near the two existing ground storage facilities. At this time the system will have to be reevaluated based on distribution of population growth and present system weaknesses. The proposed system as expanded throughout the planning period would provide the town of Baker with a complete water system facility which would meet present day standards. Further study and economic considerations would be necessary to determine the most

feasible locations for the proposed additional facilities.

Plevna

Existing System. The estimated 1970 population of Plevna is two hundred. Population projections indicate that this population will decrease slightly throughout the planning period. The area presently served by the existing water system includes the entire community as shown on Map 6. At the time this report was prepared, a map showing the system layout was not available.

Water supply for this system is provided by two wells located within the community and capable of producing seventy five gpm. The water obtained from these wells is of good quality, and no treatment is provided. Storage for the water system consists of a 35,000 gallon storage tank and a one thousand gallon pressure tank located within the system. The distribution system consists of older pipe in fair condition and over 2,500 feet of newly placed, two inch, plastic pipe. This system reportedly provides the residents of Plevna with satisfactory water flows and pressure, and no major problems have been reported.

The analysis criteria of this report indicates that the present yield of the well sources and the present capacity of the storage facilities are just under that required for the projected 1975 population. Population projections indicate a downward trend through 1990, thus no additions or improvements to the system are proposed.

Improvements by 1990. The population of Plevna is expected to be 150 by 1990. The present water system will continue to provide the residents of this community with adequate water supply throughout this period. The only improvements which may become necessary during this time would be replacement of small diameter lines or looping of dead end lines to provide proper pressure and flow characteristics within the system. Also, it may become necessary during this time to provide some method of treatment for the water obtained from the wells.

COMMUNITY SEWER SYSTEM FACILITIES

General

Each use of water adds some material or alters some characteristic enough to change the original quality of the water and often to pollute it. The transportation and dilution of municipal, industrial,

and agricultural wastes are important and necessary uses of water; therefore, special emphasis is placed on the control of water pollution from these sources. Some of these wastes can be carried in limited amounts without damage to the resource. Some wastes if discharged into water courses can make their way into underground aquifers and pollute the ground water so that it is unsuitable for further use.

Pollution by definition and interpretation is a matter of degree. Since it is inevitable that the quality of water will be altered with each use, it is of critical importance to control the degree of pollution.

It is public policy established by the state legislature to maintain reasonable standards of purity for the water of the state. These standards are to be consistent with the use of these waters, including their use in carrying away the water borne waste products of society. The current Federal Water Pollution Control Act in reference to pollution abatement gives the individual states discretion in assessing the physical and economic feasibility of complying with water quality standards. The "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" of the Montana Water Pollution Control Council for streams and rivers in Montana have been included in Appendix I.

Sewage may be broadly categorized as domestic or municipal waste, industrial waste, and animal or agricultural waste. Animal wastes are usually not involved in community sewage facilities; however, they do constitute a potential source of pollution which must be controlled and prevented from entering streams or other potential water supplies.

Although industrial activity throughout Montana has been limited, the need for control and treatment of industrial wastes is apparent. Industrial wastes vary in quantity and composition as greatly as the products and processes which generate them. They include toxic chemicals, solids carried in suspension, brines, strong acids and alkalies, oils, dyes, floating solids, and the heat generated by industrial processes. Industrial wastes are not found to be a major factor in the design of most community sewage facilities. Where economic projections indicate industrial development, the relationship to loading on domestic sewer systems is considered.

Domestic sewage is the primary consideration of this study and has been the basis for design and analysis. Where particular systems are subjected to loading from industrial sources, a more detailed study will be necessary. The general approaches outlined in "Analysis Criteria" in Appendix III will suffice in practically all cases.

Basic Considerations

There are generally three main methods of sewage disposal. These are septic tanks, mechanical sewage treatment plants, and wastewater stabilization ponds. Local soil conditions, availability of land, and density of population are the basic factors which govern the selection of a particular method.

Many of the smaller communities have relied on individual septic tanks and cesspools for each home to handle sewage disposal. Septic tanks are suitable if the population density is low and if the systems are properly designed and maintained. Overflow from these tanks must drain into the soil and, depending on local soil conditions, may or may not create a problem. There is a limit to the amount of water that even loose granular soil can absorb. Density of population and the length of time the effluent has been entering the soil are factors which indicate whether septic tanks can be suitable for sewage disposal.

When economically feasible, community sewage collection and disposal systems are much more desirable than individual systems. Community systems eliminate the worry of septic tank failure, the danger of well contamination, and the problem of soil saturation. However, it is usually uneconomical to serve a few homes scattered over a large area with a community sewer system.

The type of sewage disposal facilities to be used can generally be determined on the basis of economic factors. Mechanical treatment plants provide an excellent means of sewage disposal although the initial cost, maintenance cost, and power cost are usually high. Wastewater stabilization ponds are an ideal method of sewage disposal and usually are the most economical to construct and maintain.

The Montana Water Pollution Control Council has established the criteria that treatment of domestic and industrial wastes shall be secondary treatment of its equivalent. For domestic sewage, mechanical treatment plants or stabilization ponds, when either is properly designed, constructed, and operated, meet these requirements.

A schedule for completion of secondary treatment facilities by communities across the state has been established by the State Department of Health. The target date is included for individual towns when applicable.

Fallon County

In Fallon County only the towns of Baker and Plevna are presently

served by community sewer facilities. Approximately 2,700, or 67.5 percent of the county population, are served by these facilities. Using population projections up to 1990, the present sewer system facilities in Baker and Plevna will be adequate to serve these communities throughout the planning period. The county population is expected to decrease throughout the planning period; however, and thus the percentage of the county population served by central sewer facilities in Baker and Plevna by 1990 will be seventy five percent. The remaining county population will live in outlying areas, and the homes will not be close enough together to make community sewer systems feasible.

Baker

Existing System. The 1970 population of Baker is estimated to be 2,500. This population is expected to increase slightly throughout the planning period. A community sewer system facility is in existence, and a layout of this system is shown on Map 7. The sewer system consists of a collection system made up of eight and ten inch diameter pipe and an outfall line of fifteen inch diameter pipe. Treatment for the sewer system is provided by three wastewater stabilization ponds with a combined water surface area of thirty acres. The wastewater stabilization ponds are located adjacent to each other in an area northwest of town. The system is currently operating satisfactorily, and the majority of the pipe in the collection network is reported to be in good condition. There have been no pollution or contamination problems apparent, and alterations or major improvements to the system have not been necessary. Population projections and the design criteria of this report reveal that the current wastewater treatment capacity will be adequate to serve the community throughout the planning period.

Improvements by 1990. By 1990 the population of Baker is expected to be 2,700, and the present sewer system facility will be adequate for the needs of the community throughout the entire planning period. Continued expansion of the collection system to serve growth areas and annual maintenance will be necessary to keep this system in satisfactory operating condition.

Plevna

Existing System. The 1970 population of Plevna is estimated to be two hundred. This population is expected to decrease throughout the planning period. The community sewer system facility is available to the residents as shown on Map 8.

A collection system, consisting of eight inch diameter sewer mains, carries sewage by gravity to the treatment facility as shown on Map 8. Treatment for the system consists of a two cell wastewater stabilization pond with a water surface area of 2.1 acres. The sewer system is reported to be in good condition, and no major expansion or improvement is contemplated. Current analysis criteria indicates that the system will be adequate to serve the community throughout the planning period.

Improvements by 1990. By 1990 the population of Plevna is expected to decrease to 150. The present sewer system as described will be adequate to handle the needs of the community throughout this portion of the planning period. During this time only normal maintenance will be required to keep this system in satisfactory operating condition.

PREFACE TO MAPS

The following maps have been prepared from several sources. The county maps were prepared from Transverse Mercator Projection Series Maps and Montana Highway Department Maps, Planning and Survey Series. The reduction of the county maps necessary for this publication makes them useful for general reference purposes only.

The town and community base maps used herein are taken from Montana State Highway Commission City and Town Plats prepared from aerial photographs dated 1961 to 1969 and have been updated where necessary. On-site surveys, plats obtained from individual towns, and aerial photography conducted in 1970 were also used. Uncontrolled mosaics have been used and scales are, accordingly, only approximate and are shown for referencing purposes only. The mapping operation was supplemented by field checks made during 1970.

Land use information was obtained by field surveys, supplemented and checked by aerial photography during 1969 and 1970.

Water and sewer systems maps show existing facilities for individual towns and communities except where the information was not available. Data concerning these community facilities was obtained from the records of the individual communities and of the State Department of Health. Water and sewer lines are shown in the center of streets to indicate the existence of lines rather than precise locations. The sizes of lines, obtained from the most current information available, are indicated when possible. The locations of recommended improvements are given as relative locations and are not meant to be scaled from the individual town or community maps.

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Title	Map Number
FALLON COUNTY TOPOGRAPHY	1
STATEWIDE UTILITIES SYSTEMS & RECREATION AREAS	2
FALLON COUNTY LAND OWNERSHIP	3
FALLON COUNTY SOILS	4
BAKER WATER SYSTEM	5
PLEVNA WATER SYSTEM	6
BAKER SEWER SYSTEM	7
PLEVNA SEWER SYSTEM	8

MAP I

COUNTY MAP
GENERAL RELIEF

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

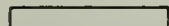
ROADS-HIGHWAYS
 STATE HIGHWAY  U. S. HIGHWAY

 RAILROADS

 STREAMS-LAKES

 COUNTY BOUNDARY

 INDIAN RESERVATION

 0-3,000 FT. ELEVATION

 3-5,000 FT. ELEVATION

 5-7,000 FT. ELEVATION

 OVER 7,000 FT. ELEVATION

MAP 2

LEGEND

MAJOR STATE-WIDE COVERAGE

POWER AND GAS SYSTEMS

-  POWER PLANT (IN MEGAWATTS)
-  1 to 50 KILOVOLTS
-  51 to 100 KILOVOLTS
-  101+ KILOVOLTS
-  PROPOSED LINES
-  GAS LINES

RECREATION AREAS

1. LOST CREEK STATE PARK
 2. LEWIS AND CLARK CAVERNS STATE PARK
 3. LAKE MARY RONAN STATE PARK
 4. MEDICINE ROCKS STATE PARK
 5. ROSEBUD STATE PARK
 6. ROCK CREEK STATE PARK
 7. MAKOSHIKA STATE PARK
 8. WEST SHORE STATE PARK
 9. WOODS BAY STATE PARK
 10. BITTERROOT LAKE STATE PARK
 11. ASHLEY LAKE STATE PARK
 12. LONE PINE STATE PARK
 13. JAMES KIPP STATE PARK
 14. HOOPER MEMORIAL STATE PARK
 15. HELL CREEK STATE PARK
 16. FINLEY POINT STATE PARK
 17. ELMO STATE PARK
 18. FLATHEAD LAKE STATE PARK
 19. YELLOW BAY STATE PARK
 20. WALSTAD MEMORIAL PARK
 21. THOMPSON FALLS STATE PARK
 22. WHITEFISH LAKE STATE PARK
 23. WAYFARERS RECREATION AREA
 24. TIBER RESERVOIR RECREATION AREA
 25. CLARK CANYON RESERVOIR RECREATION AREA
 26. ENNIS RECREATION AREA
 27. DEADMAN'S BASIN RESERVOIR RECREATION AREA
 28. PAINTED ROCKS RESERVOIR RECREATION AREA
 29. CANYON FERRY RECREATION AREA
 30. LOGAN PARK RECREATION AREA
 31. NELSON RESERVOIR RECREATION AREA
 32. BEAVERTAIL HILL RECREATION AREA
 33. GLACIER NATIONAL PARK
 34. YELLOWSTONE NATIONAL PARK
-  NATIONAL FORESTS

MAP 3

COUNTY MAP LAND OWNERSHIP

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

ROADS-HIGHWAYS

———— STATE HIGHWAY U. S. HIGHWAY

— — — — RAILROADS

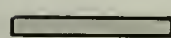
 STREAMS-LAKES

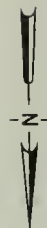
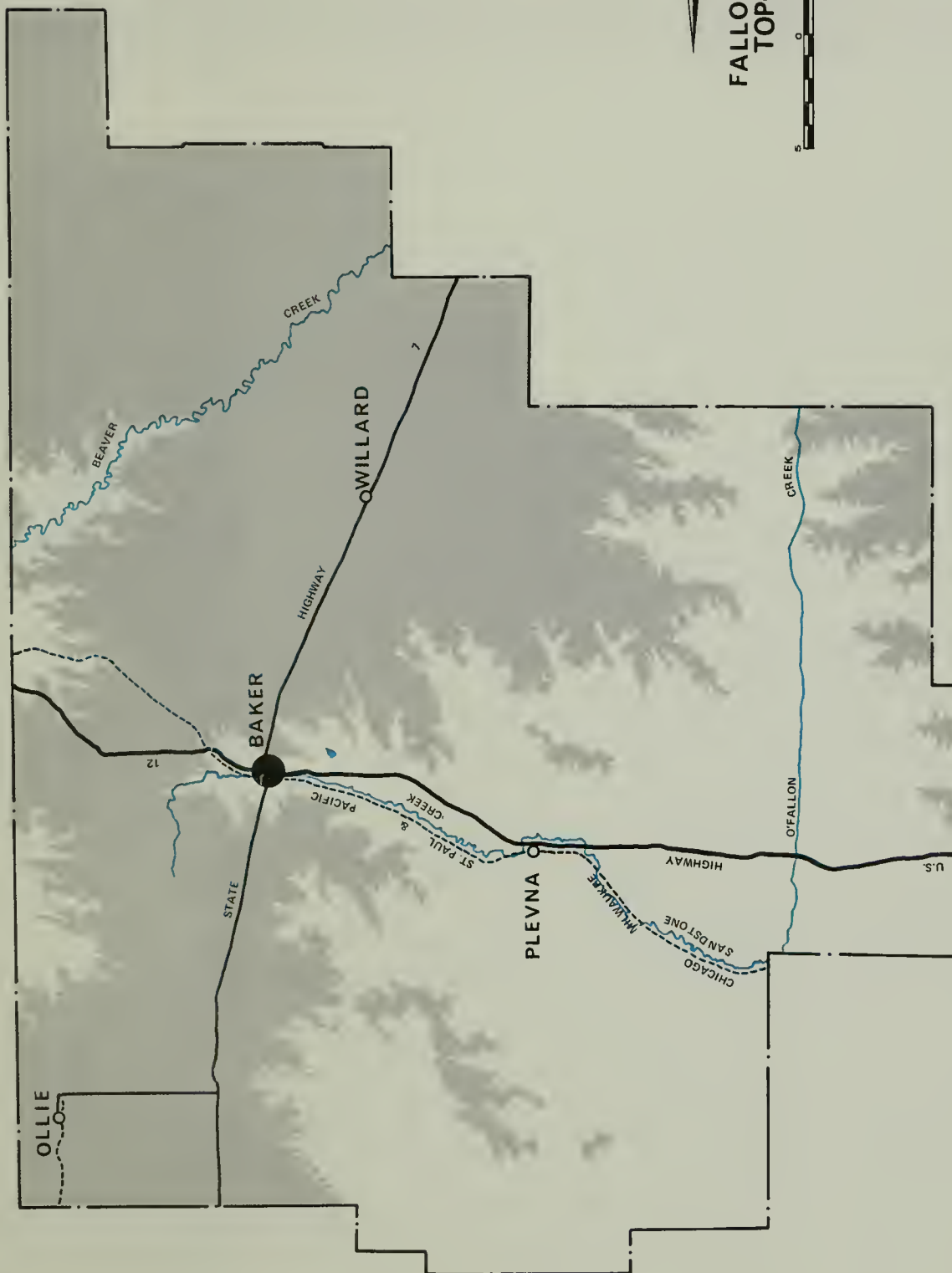
— COUNTY BOUNDARY

 INDIAN RESERVATION

 PRIVATELY OWNED LAND

 STATE OWNED LAND

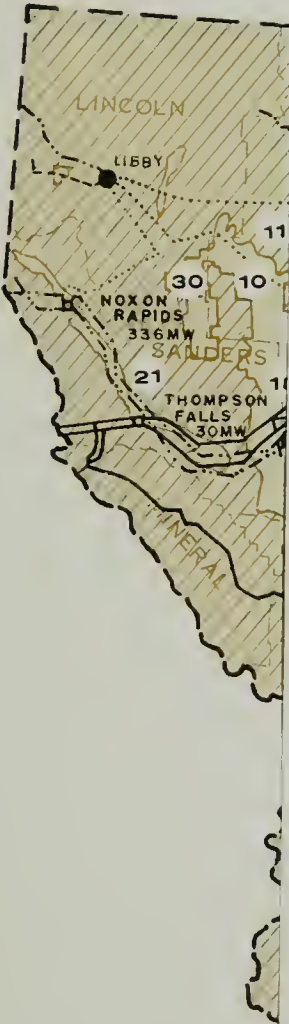
 FEDERAL OWNED LAND



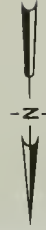
FALLON COUNTY TOPOGRAPHY



MAP 1



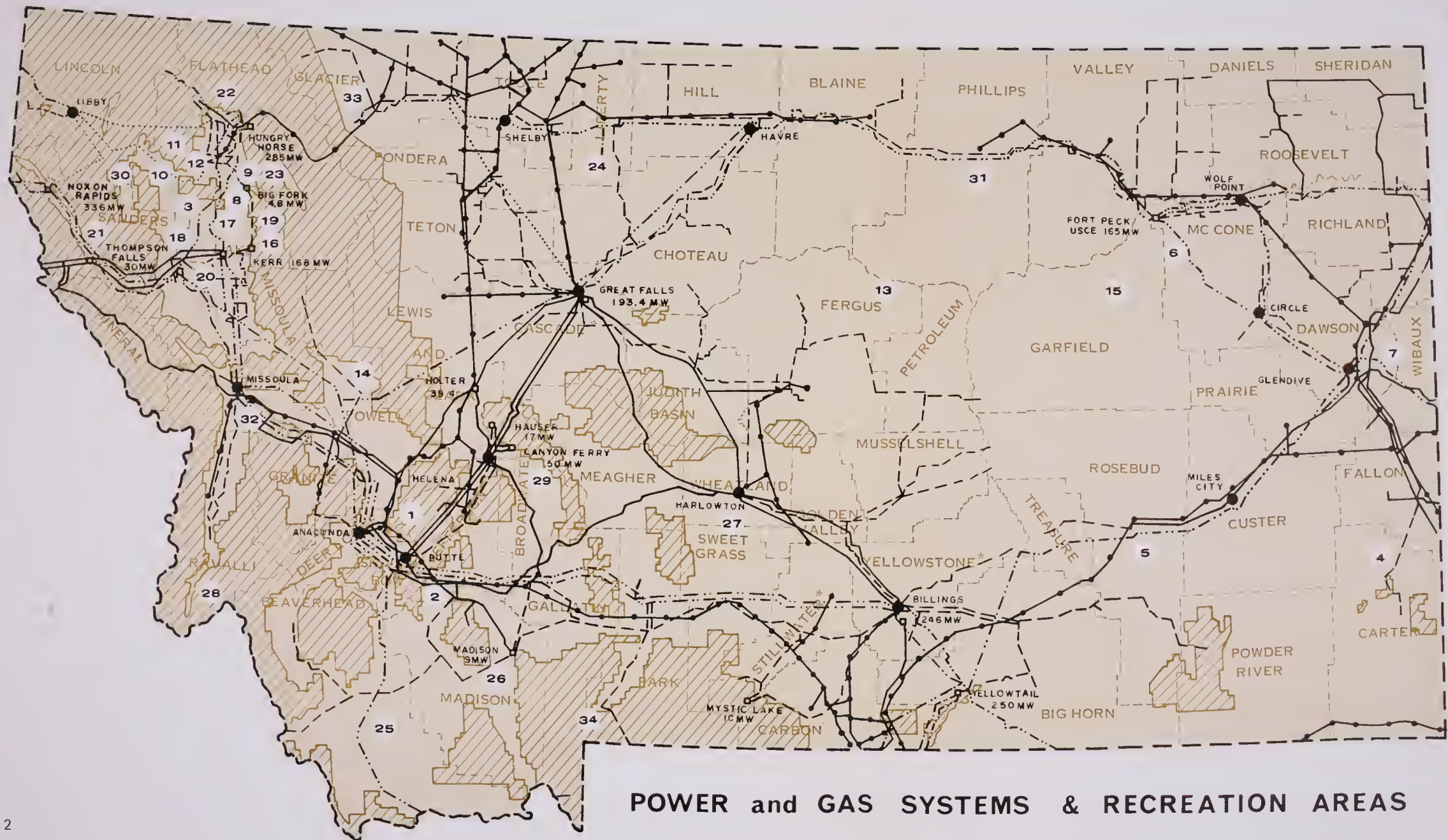
MAP 2

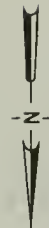
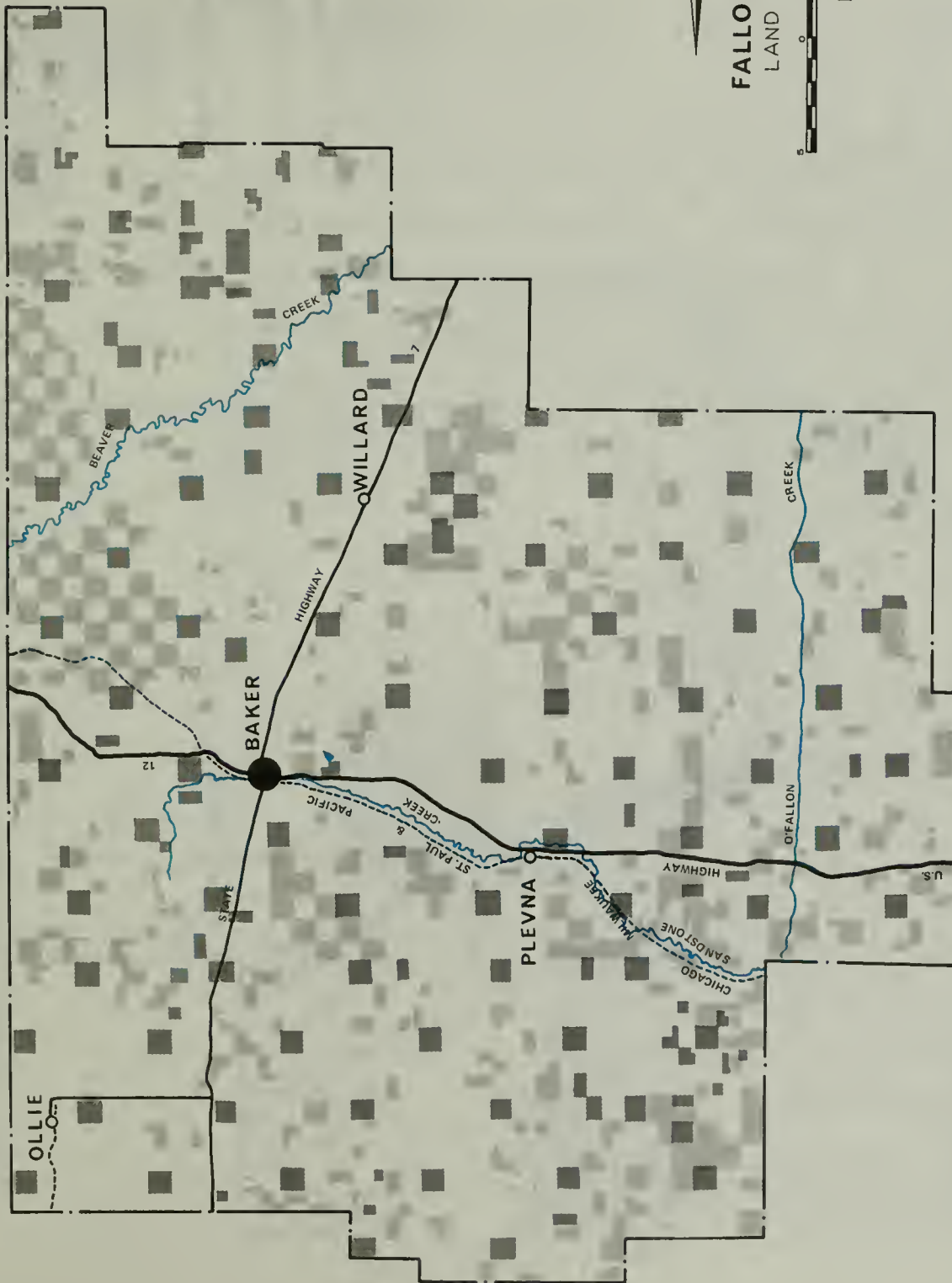


ALLON COUNTY
LAND OWNERSHIP

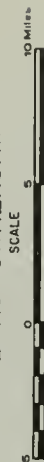


MAP 3

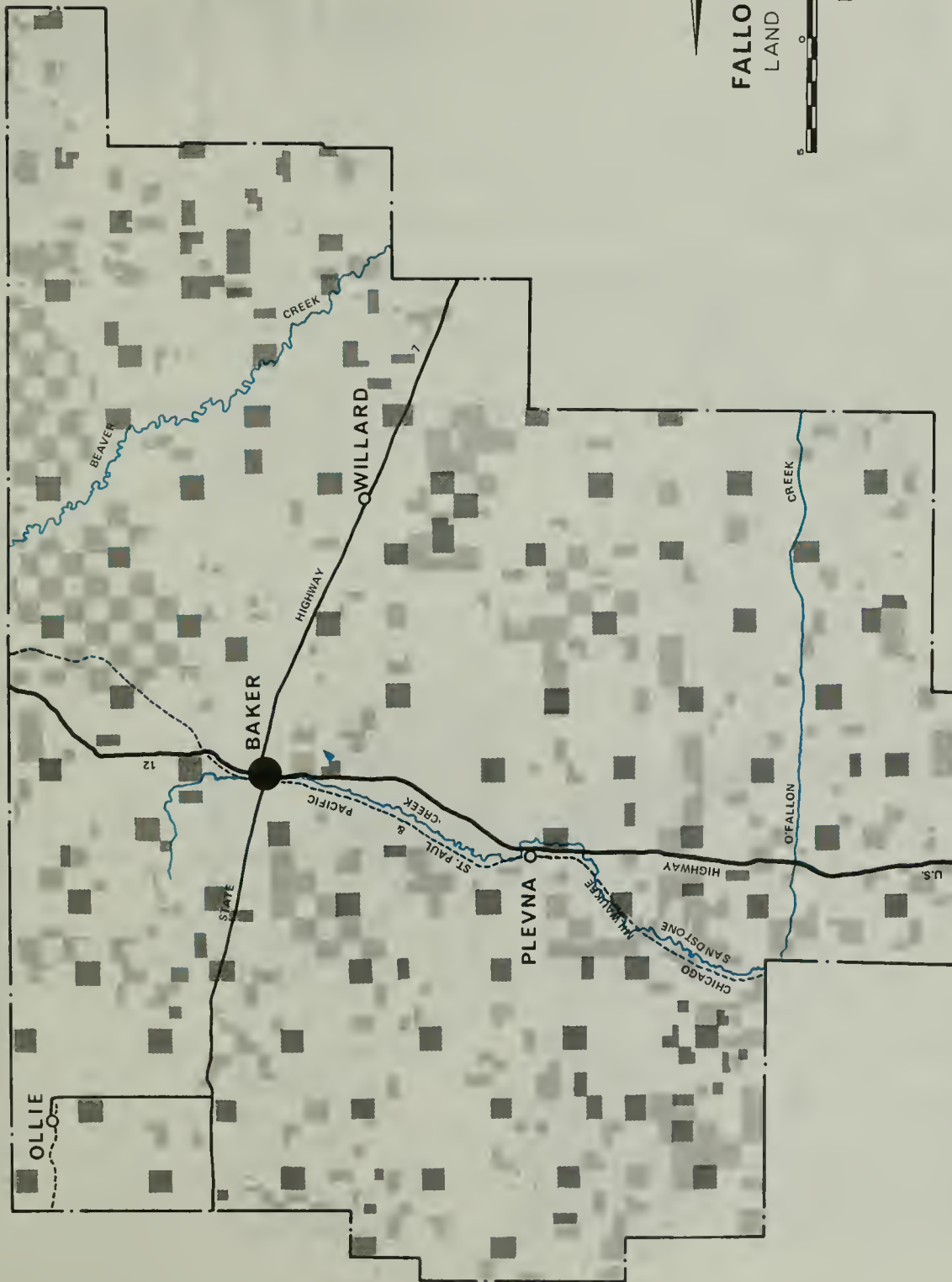




FALLON COUNTY LAND OWNERSHIP

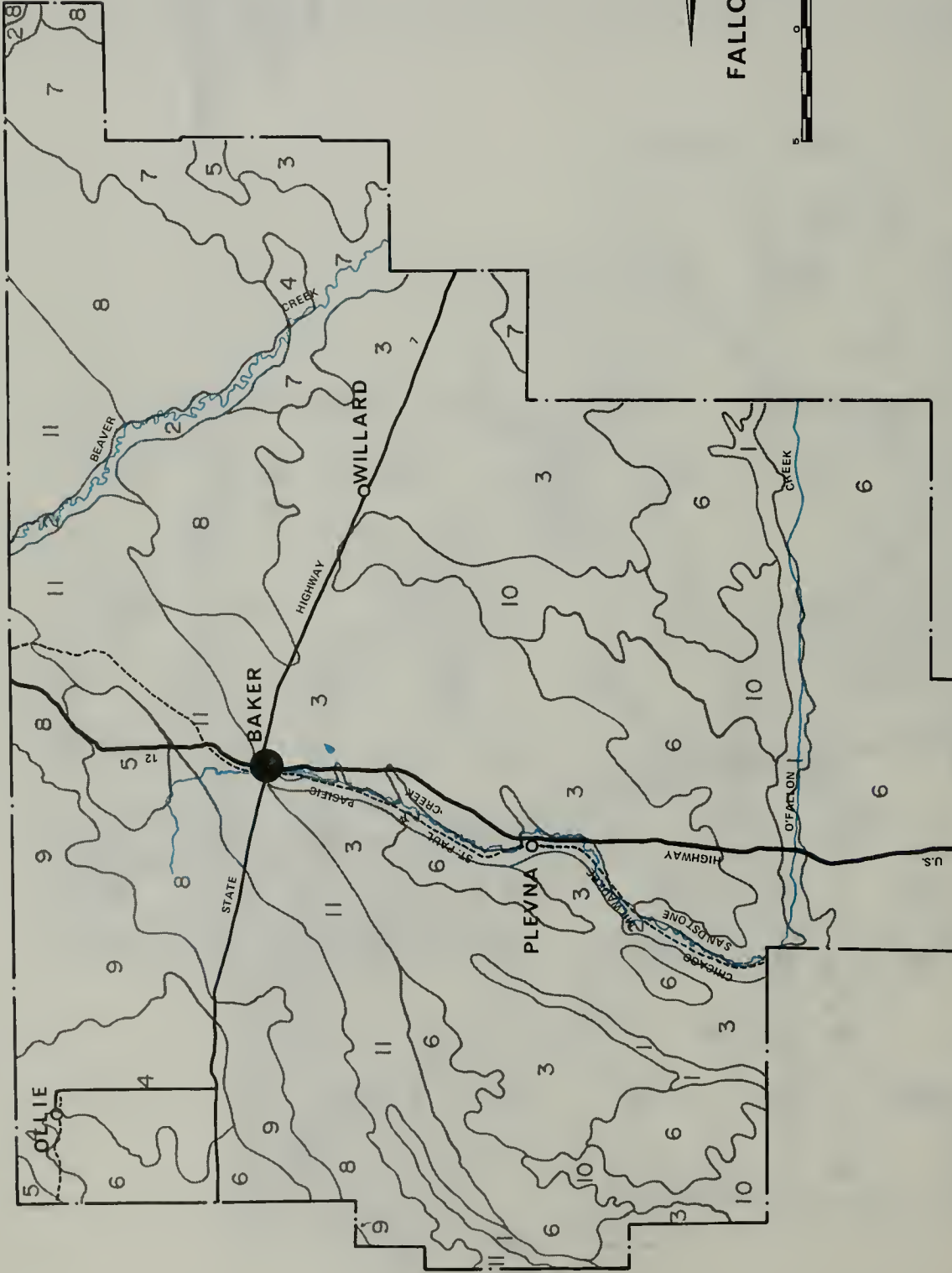


MAP 3



FALLON COUNTY
LAND OWNERSHIP

MAP 3

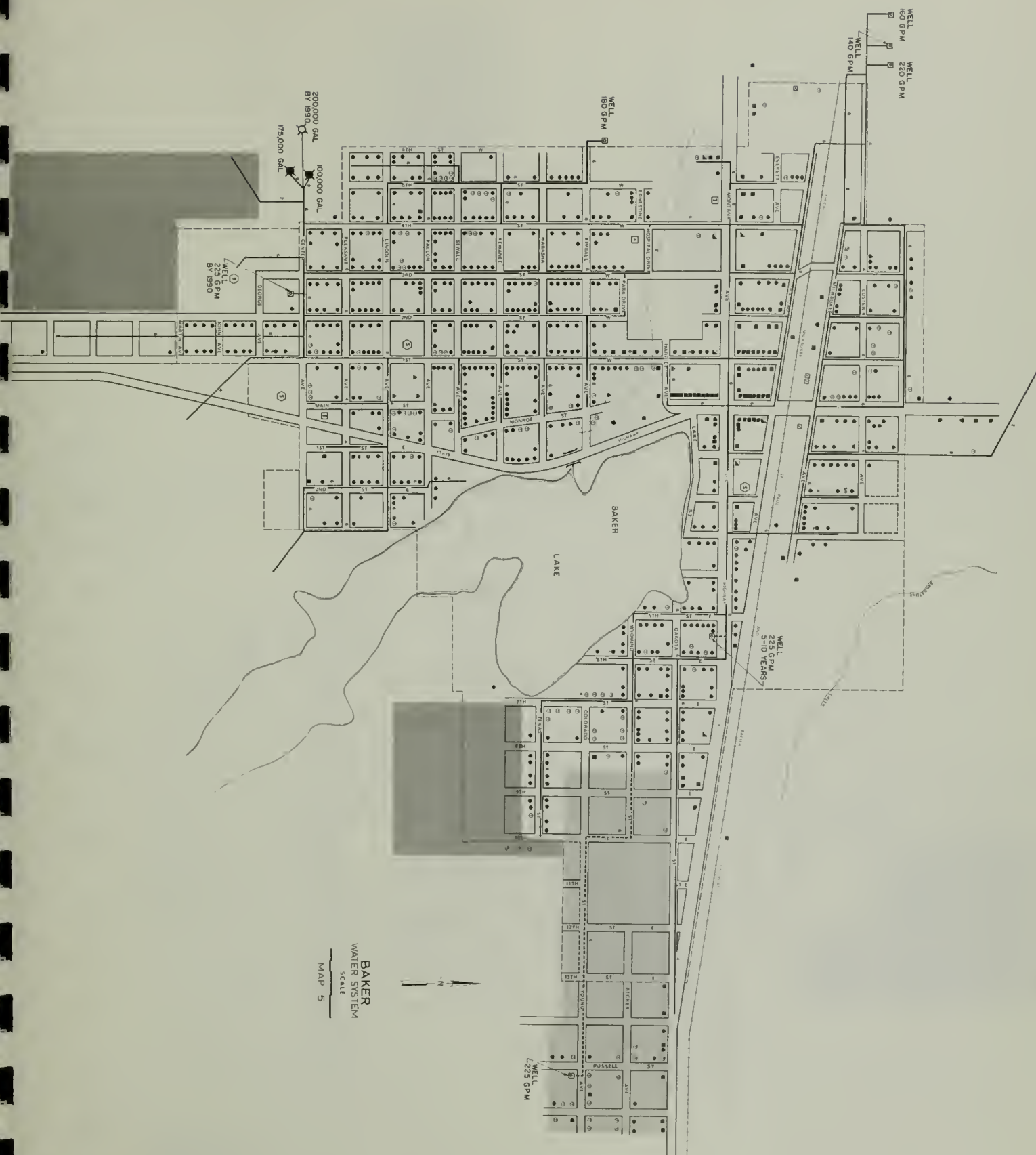


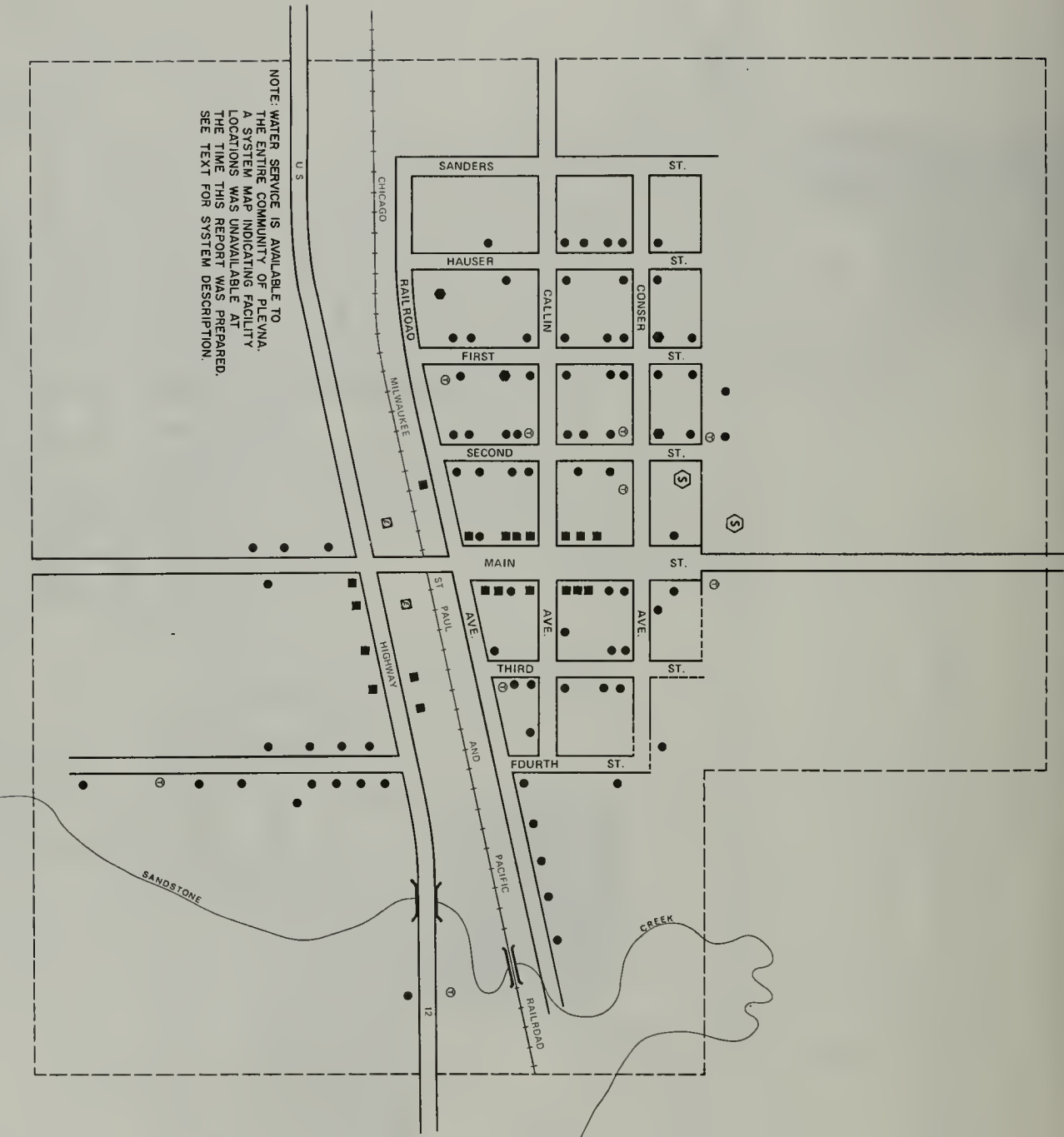
FALLON COUNTY
SOILS

MAP 4

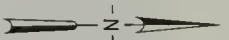
SCALE 0 5 10 Miles

NOTE: Numbers correspond to soils descriptions listed in the text.
SOURCE: USDA Soil Conservation Service



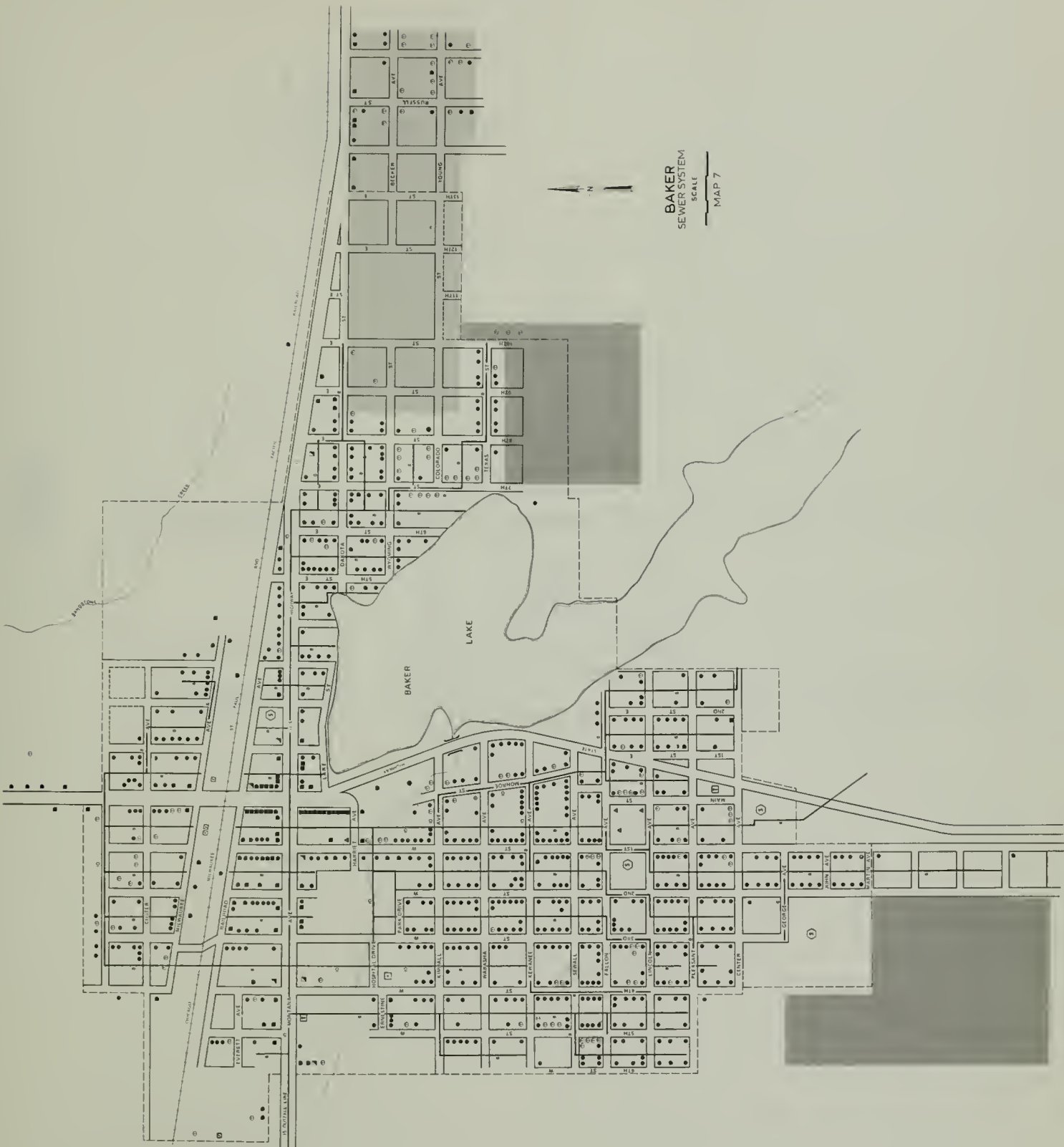


NOTE: WATER SERVICE IS AVAILABLE TO THE ENTIRE COMMUNITY OF PLEVNA. A SYSTEM MAP INDICATING FACILITY LOCATIONS WAS UNAVAILABLE AT THE TIME THIS REPORT WAS PREPARED. SEE TEXT FOR SYSTEM DESCRIPTION.

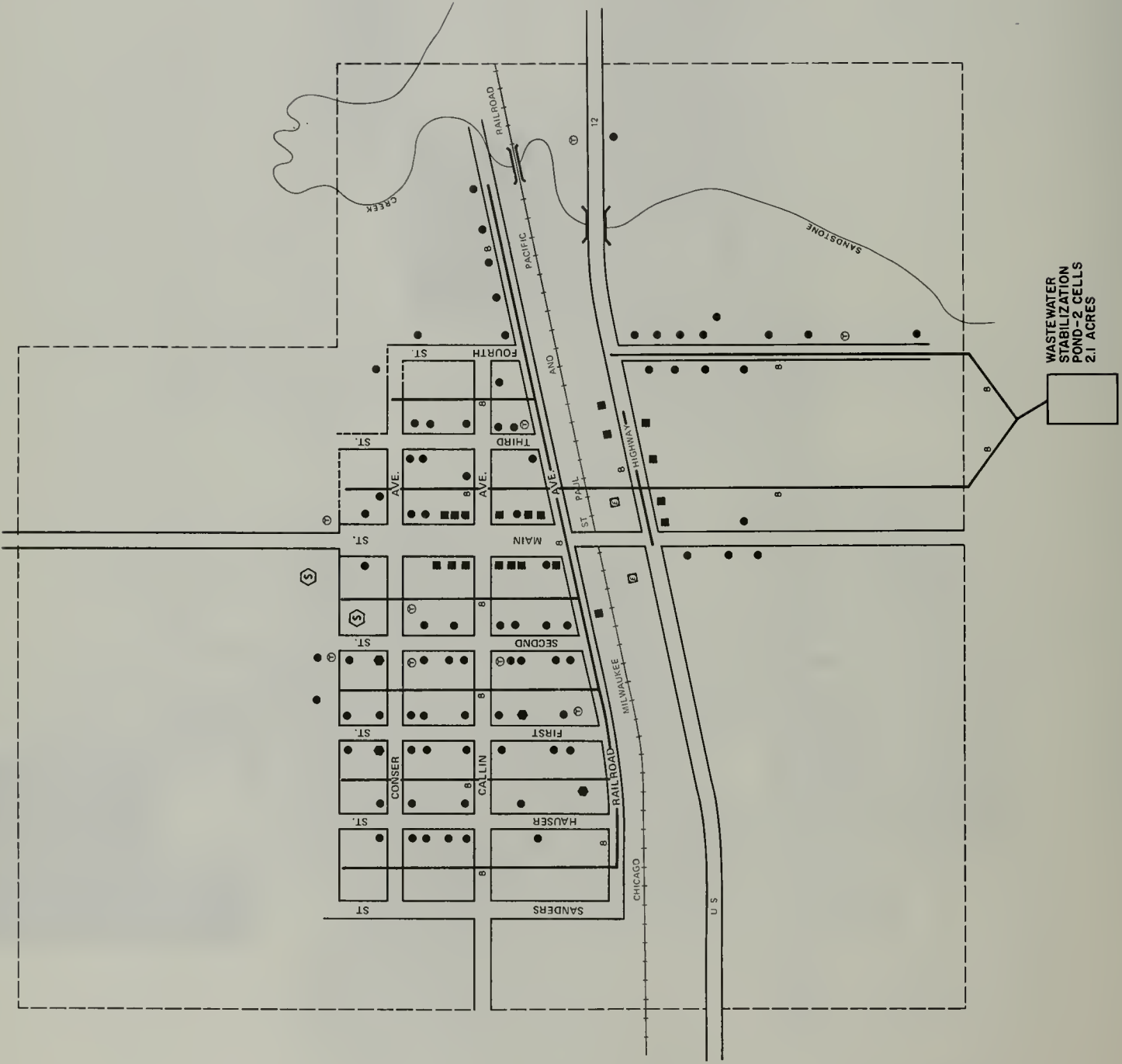


PLEVNA
WATER SYSTEM
SCALE
MAP 6

WASTEWATER
STABILIZATION
POND-3 CELLS
30 ACRES



BAKER
SEWER SYSTEM
SCALE
MAP 7



CARTER COUNTY

MONTANA

CARTER COUNTY
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CONCLUSIONS, RECOMMENDATIONS, AND PRIORITIES

Conclusions

The total population of Carter County is expected to decrease steadily throughout the planning period, and the communities of Carter County will all show a similar decrease in population according to predictions currently in use.

The existing water and sewer systems in Ekalaka are in generally good condition although some improvements are necessary. Additions and revisions are proposed and discussed for these systems. The possible need for central systems in the community of Alzada is reviewed, and systems which would serve this community adequately are described. Central systems are not believed to be necessary for the small rural communities of Boyes and Hammond, and indications are that individual systems will continue to serve these communities satisfactorily throughout the planning period.

Recommendations

This plan shows the various types of improvements which the communities should be considering during the planning period. Elaborate systems are not proposed but rather those facilities necessary to provide safe and adequate community systems. It is recommended that this general plan be adopted by the governing agencies of each community. A detailed approach, which must be undertaken to insure completion of the improvements in each community, cannot be covered in a report of this type. Community leaders, however, do have several courses of action which may be taken.

Most small communities do not have the means to plan and finance complete water and sewer systems. Therefore, to enable communities to acquire such facilities, five departments of the Federal Government have legislation authorizing loans or grants for construction of public works. These agencies are:

Farmers Home Administration
United States Department of Agriculture
P.O. Box 850
Bozeman, Montana 59715

Federal Water Quality Administration
United States Department of the Interior
% Montana State Department of Health
Helena, Montana 59601

Public Health Service
United States Department of Health, Education, and Welfare
Division of Indian Health
Billings, Montana 59101

Administration for Metropolitan Development
United States Department of Housing and Urban Development
Assistant Regional Administrator
Denver Regional Office
1050 South Broadway
Denver, Colorado 80209

Economic Development Administration
United States Department of Commerce
Montana Field Coordinator
207 Medical Arts Building
Butte, Montana 59701

The legislation is constantly changing; therefore, community leaders should investigate the various alternatives and determine which program and course of action would be most beneficial to them.

Priorities

That a particular system requires immediate improvements and another system will be satisfactory for a definite period are difficult to establish. Several indicators for establishing priorities are available, however. The general health of the people is the prime consideration, and this can only be insured when safe water supplies are provided. Water supply in adequate quantities is another important factor. Waste water must be treated and disposed of by safe methods to minimize the problems of pollution and to protect public health. The total number of persons benefited by any improvement must also be considered. These basic criteria were used in establishing the following priority listing:

1. Ekalaka Sewer System. The sewage treatment plant in Ekalaka does not currently operate properly, and thus the renewal or replacement of this plant is a top priority project. The elimination of the potential health hazard and the number of people who would benefit from the construction of this project justify immediate action.

2. Alzada Sewer System. The local demand for this improvement has not developed; however, the present lack of central sewer facilities and the number of persons who would benefit from such a system make the project necessary and feasible.

3. Ekalaka Water System. The proposed addition of storage and supply for this system will only be necessary if a reevaluation of population trends toward the end of the planning period indicates a need for these facilities. Improvements to the present facilities as proposed should be done during the planning period, however.

4. Alzada Water System. This proposed improvement is not immediately needed; however, following the construction of a central sewer system or the advent of well contamination problems, planning for construction of this project should begin.

This list of priorities is not intended to govern the order in which action should be taken. The order merely ranks the severity of the problems and the need for improvements.

THE LAND

General Characteristics

Carter County is located in the most southeastern corner of the State of Montana. It is bounded by South Dakota to the east and by Wyoming to the south. Custer and Powder River Counties join on the western boundary while Fallon County lies to the north. The county encompasses a total of 3,313 square miles, and there are very little amounts of water surface areas within the county.

The topography on Map 1 indicates that the land is generally flat and interspersed with numerous small coulees and breaks. There are several higher peaks located between the various drainage basins. Elevations vary from a low of around three thousand feet to a high of 4,215 feet located in the Chalk Buttes in the western part of the county. The lower areas generally are found in the broad valley surrounding Box Elder Creek and run northeasterly through the county. Other low areas are found in the vicinity of the Little Missouri River in the south and Little Beaver Creek in the north.

Highways in the county are generally characterized by the gravel type. The exceptions are U. S. Highway 212 which traverses the southwest part of the county for about thirty eight miles and State Highway 7 which goes from Ekalaka to Baker in Fallon County. The highway and road system helps to establish marketing and buying patterns since there is no railroad service in the county. The southern areas rely on Belle Fourche in South Dakota while the northern areas participate with Baker to the north in Fallon County.

There are no commercial airports in the county, however, Ekalaka has a

3,400 foot unpaved airfield which has very limited aircraft servicing facilities. In addition to the field at Ekalaka, there are two private fields; one is in the vicinity of Ridge and the other is southwesterly of Ekalaka near Chalk Buttes.

Electrical power is supplied by the Southeast Electric Cooperative, Inc. located in Ekalaka. All the power is purchased from the Upper Missouri G & T Electric Cooperative in Sidney, Montana and is received from the transmission line which extends from Baker to Ekalaka and then southeasterly along Montana trail 323 for fifteen miles.

Since major power producing centers and relay stations are usually located at widely separated points and provide power service to large areas, Map 2 shows the major power grid system for the entire State of Montana. Major gas transmission lines are also shown.

Telephone service is provided by four separate companies. The largest area, which includes Ekalaka, is served by the Treasure State Telephone Company. Range Telephone Cooperative serves a large area around Alzada and along the western border of the county. The Mid-Rivers Telephone Cooperative serves an area southerly from Willard in Fallon County which includes the territory around Mill Iron. Mountain States Telephone serves a small area around Ridge in the southwest corner of the county.

Land Ownership and Use

As seen in Chart 1, there are three ownership categories in the county. Private ownership is the largest and accounts for almost two acres of every three. Land under federal ownership represents twenty eight percent while the State of Montana claims the remaining seven percent.

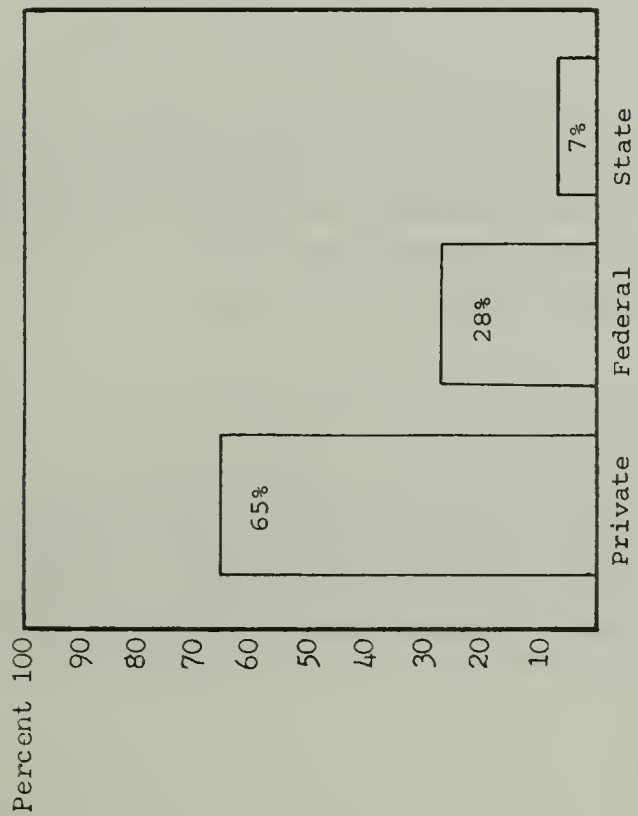
The land use pattern generally reflects the physical characteristics of the county. Ninety three percent of all lands are in agricultural use, thus reflecting the suitability of the land for cattle grazing. Four percent of the land is covered by forests, mainly those of the Custer National Forest. The remaining three percent consists of land used for town sites, transportation routes, water surface areas, and other uses not included in the first two categories.

Natural Resources

In 1967 the leading natural resources of Carter County in order of economic importance were clays and petroleum.

CHART 1

Land Ownership
Carter County



Square miles

2,145

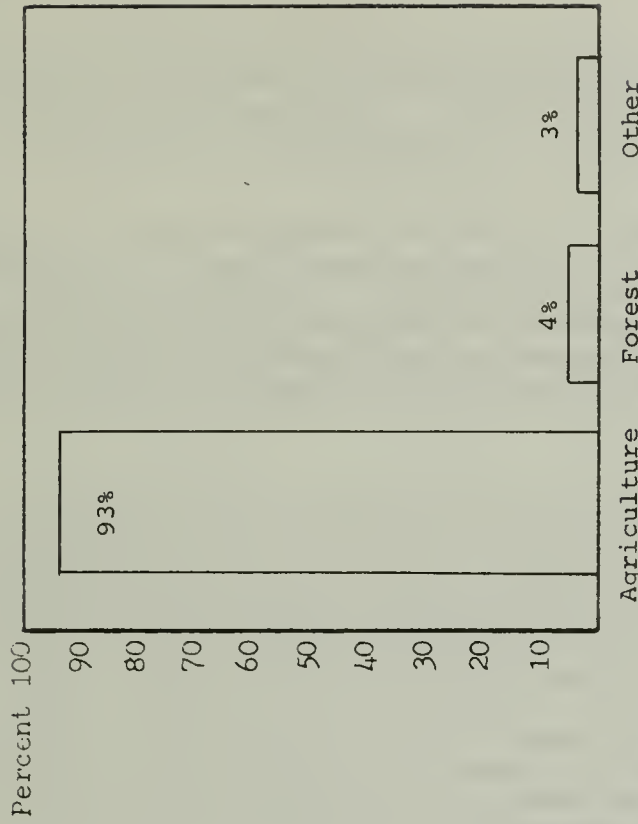
942

226

Source: The Montana Almanac, 1959-60

CHART 2

Land Use
Carter County



Square miles

3,074

140

99

The county is one of the leading producers in the state of bentonite, an extremely fine textured clay material used mainly for drilling mud in oil and gas operations. The largest mine is the National Lead Company mine near Colony.

Another important resource that remains largely untapped due to high extraction costs is coal. Coal bearing lands cover 1,305 square miles, thirty nine percent of the county. The Department of the Interior estimates there are 463,000,000 short tons of coal, mainly lignite, in the county representing just less than one percent of all coal in Montana. These coal bearing areas are part of the Fort Union Coal Region.

Recreational opportunities in the county range from big game hunting to sightseeing the strange geologic formations found in the area. The low lying hills and the plains provide an ideal habitat for antelope that lure hunters from several surrounding states. Whitetail and mule deer frequent the forested hills and river breaks and wild turkeys along with other upland game birds abound in the county. Recreational possibilities are further enhanced by parts of the Custer National Forest which lie within the county. North of Ekalaka, Medicine Rocks State Park, named for ancient Indian rituals which were performed there, consists of strange and unusual geologic formations caused by erosion over the centuries. Fossils can also be found there as well as throughout the county and a fine geologic museum is located at Ekalaka.

Soils

Soils in the county are generally those of the range grass supporting type. Almost three fourths of all agricultural activities were livestock producing, thus reflecting the grass bearing qualities of the land. Forest type soils in small quantity are located in the areas of the Custer National Forest and higher elevations.

Soils data is covered in detail later in this report.

Water

Surface water is scarce in Carter County. The Box Elder Creek and the Little Missouri River are the two main drainages. The first originates in the southwest corner of the county, drains northeasterly, and empties into the Little Missouri River in South Dakota. The second drainage enters the county from Wyoming in the vicinity of Alzada and exits into South Dakota near the Capitol area. There are other minor creeks and drainages in the county that will be covered in detail later

in this report along with the ground-water resources.

THE PEOPLE

Population

For analytical and projective purposes, it is necessary to study the population history of Carter County to find out what has happened and what is expected to happen. Chart 3 graphically shows the growth of the county as compared with that for Montana and indicates the future growth for both.

Since 1920 the number of persons living in the county increased in only one census period. During that ten year period the population rose by 164 persons to give the 1930 Census a four percent gain over the decade. Since that time the population has declined substantially resulting in the 1970 estimate being about half of that recorded fifty years earlier. The projected 1990 figure will be about one third of that recorded in 1920.

In 1960 Carter County was classified as a rural area containing no urban areas and being located neither in nor near a major aggregate of urban population. Table 1 indicates the change in population for the urban, farm, and rural non farm areas of the county. The urban population declined faster than did its rural counterpart. Population in that category declined by eighteen percent as compared to only seven percent in the rural areas. In the last group the farm segment dropped by one eighth while the rural non farm increased by three fourths. Between 1960 and 1970 the rural population declined five times faster than in the urban areas. Over the twenty year reporting period the urban population continued to represent approximately one third of the total population. Persons living on farms dropped from sixty one percent to fifty percent of all persons while the rural non farm segment increased from six to fifteen percent percent.

The population of the county decreased by 305 persons between 1950 and 1960. Chart 4 indicates that the drop is a result of a net migration loss of 675 persons and an excess of 980 births over deaths.

The 1950 to 1960 change in sex composition is shown in Chart 5. The ratio of both sexes remained fairly even over the ten year period. A slight centralization move occurred resulting in a small gain for females. The ratio should become somewhat closer throughout the twenty year planning period.

CHART 3

COMPARATIVE
POPULATION
TRENDS

Carter County
and Montana

Sources:

1. U.S. Census of
Population
2. Intermountain
Planners, Inc.

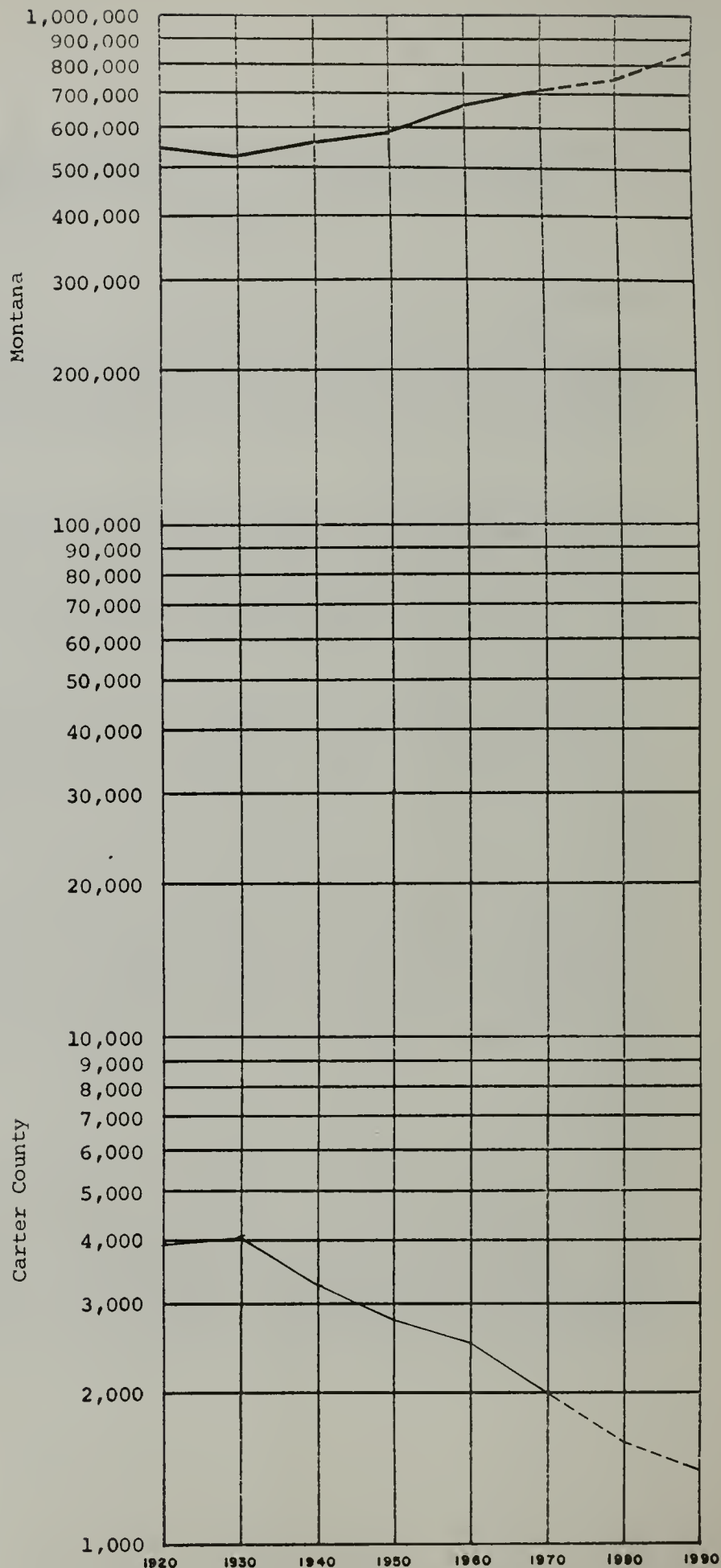


TABLE 1

Urban-Rural Population Changes for Carter County

1950-1970

	<u>1950</u>	<u>1960</u>	<u>Changes Number</u>	<u>1950-1960 Percent</u>
Total	2,798	2,493	-305	-10.9
Urban				
(Inc. Towns)	904	738	-166	-18.4
Rural	1,894	1,755	-139	- 7.3
Farm	1,716	1,444	-272	-15.9
Non Farm	178	311	+133	+74.9
	<u>1960</u>	<u>1970</u>	<u>Changes Number</u>	<u>1960-1970 Percent</u>
Total	2,493	2,000	-493	-20.6
Urban				
(Inc. Towns)	738	700	- 38	- 5.1
Rural	1,755	1,300	-455	-25.9
Farm	1,444	1,000	-444	-30.7
Non Farm	311	300	- 11	- 3.5

Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

The age distributions by sex for 1950 and 1960 are shown in Table 2. With the exception of the five through fourteen and the forty five to fifty four age groups, losses occurred within all levels.

A total of four towns and communities were studied in Carter County. The list includes the incorporated town of Ekalaka and the three unincorporated communities of Alzada, Boyes, and Hammond. The communities of Capitol and Mill Iron were also studied but were not included in this report because of insufficient population and development.

Because of the time that has elapsed since the 1960 Census, current population estimates had to be derived from several sources in the

TABLE 2

Age & Sex Composition of Carter County

<u>Age Group</u>	<u>1950</u>		<u>1960</u>	
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
Under 5	192	174	150	135
5-14	271	240	294	249
15-19	113	78	102	84
20-24	91	109	75	53
25-34	240	193	163	139
35-44	192	150	165	149
45-54	135	116	156	121
55-64	155	97	106	96
65-74	104	71	89	65
75 +	51	26	52	50
Total	1,544	1,254	1,352	1,141

Source: U. S. Census of Population, 1950-1960

TABLE 3

Population Forecast for Towns and Communities

Carter County

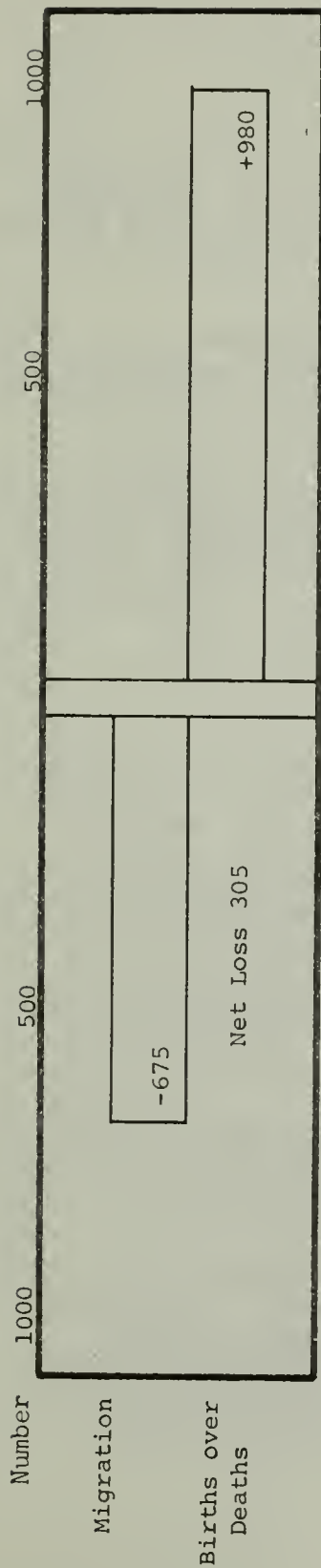
	<u>1950</u>	<u>1960</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1990</u>
Alzada	60	50	55	50	50	40
Boyes	20	15	16	12	10	5
Ekalaka	904	738	700	675	650	550
Hammond	12	10	11	10	8	5

Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

CHART 4

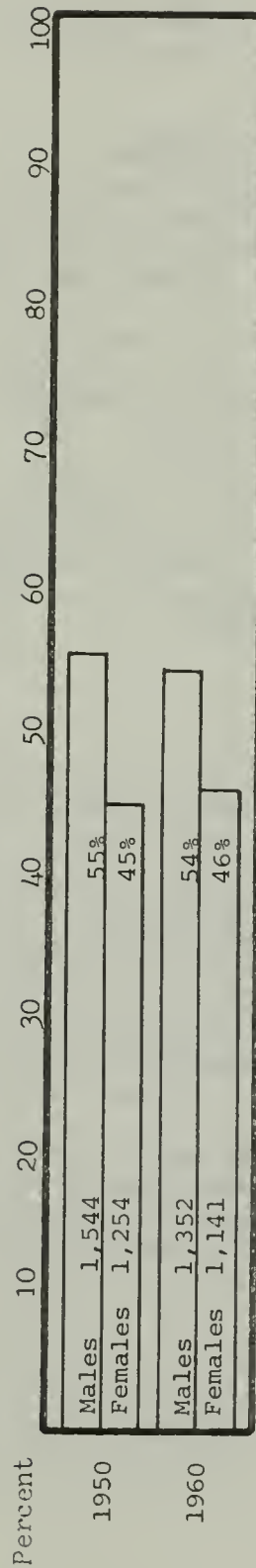
Population Change
Carter County 1950 - 1960



Source: Net Migration of Population, 1950-1960 by Age, Sex, and Color,
U. S. Department of Agriculture

CHART 5

Population by Sex
Carter County 1950 - 1960



Source: U. S. Census of Population, 1950-1960

field. Surveys and interviews were conducted to determine what now exists and what is expected in the future. Table 3 indicates the past population experience and the future projections for each town and community.

The town of Ekalaka will remain the major urban center for the county throughout the twenty year planning period. The number of persons in the town has continually become smaller for the past twenty years. The projected 1990 population of 550 persons reflects more than a one fifth decrease over the 1970 estimate.

Population has also been on the decrease for the communities of Alzada, Boyes, and Hammond. The trend is expected to continue through 1990 resulting in substantially smaller populations than that which presently exists.

The population figures reflect only those factors and trends for which information is available. New technological advances, new industries, or other unforeseen events may alter these projections. If such an event occurs, the areas affected should be studied in light of the new conditions.

Housing

There were 884 housing units within Carter County in 1960. Just more than half were classified as rural non farm, and Chart 6 indicates the rest were farms. Since there were no recognizable urban centers in 1960, there was no urban classification of housing units as found elsewhere in Montana. The median housing unit size was 4.10 rooms per unit, and the median household size per occupied unit was 3.28 persons. Almost two thirds of all units were owner occupied while about one fourth were used for rental purposes. Chart 7 indicates that fifteen percent were vacant. The 1960 condition of housing is shown in Chart 8. Only six percent were in need of replacement and thirty percent needed repair. The remainder were classified as sound.

Chart 9 reflects the 1960 status of housing units in terms of source of water, water supply, and method of sewage disposal. For geographical reference, the data shows the status for Carter County as a whole and for the farm and rural non farm housing units.

Only one third of all housing units were served by a public water system or by a private company in 1960. Those served included sixty percent of the rural non farm units and one percent of the farms. Generally, individual wells provided the most common source of water. Wells served almost three fourths of the farms and one fourth of the rural non farm units. One fifth of all units, including fifteen

HOUSING
Carter County 1960

Chart 6
Housing Classification

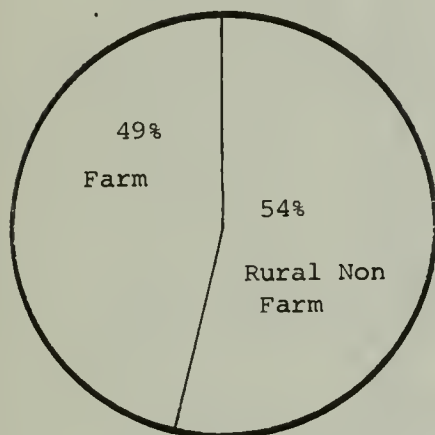


Chart 7
Housing Tenure

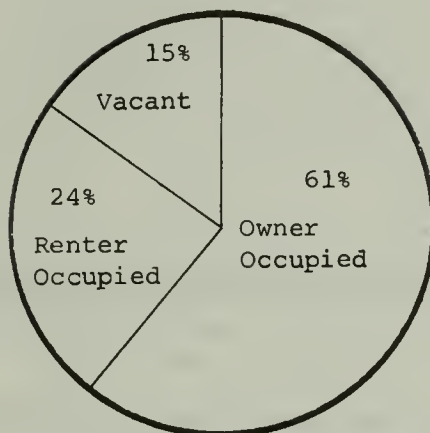
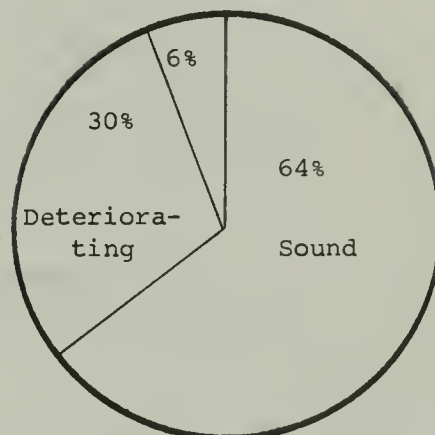


Chart 8
Housing Condition
Dilapidated



Source: U. S. Census of Housing, 1960

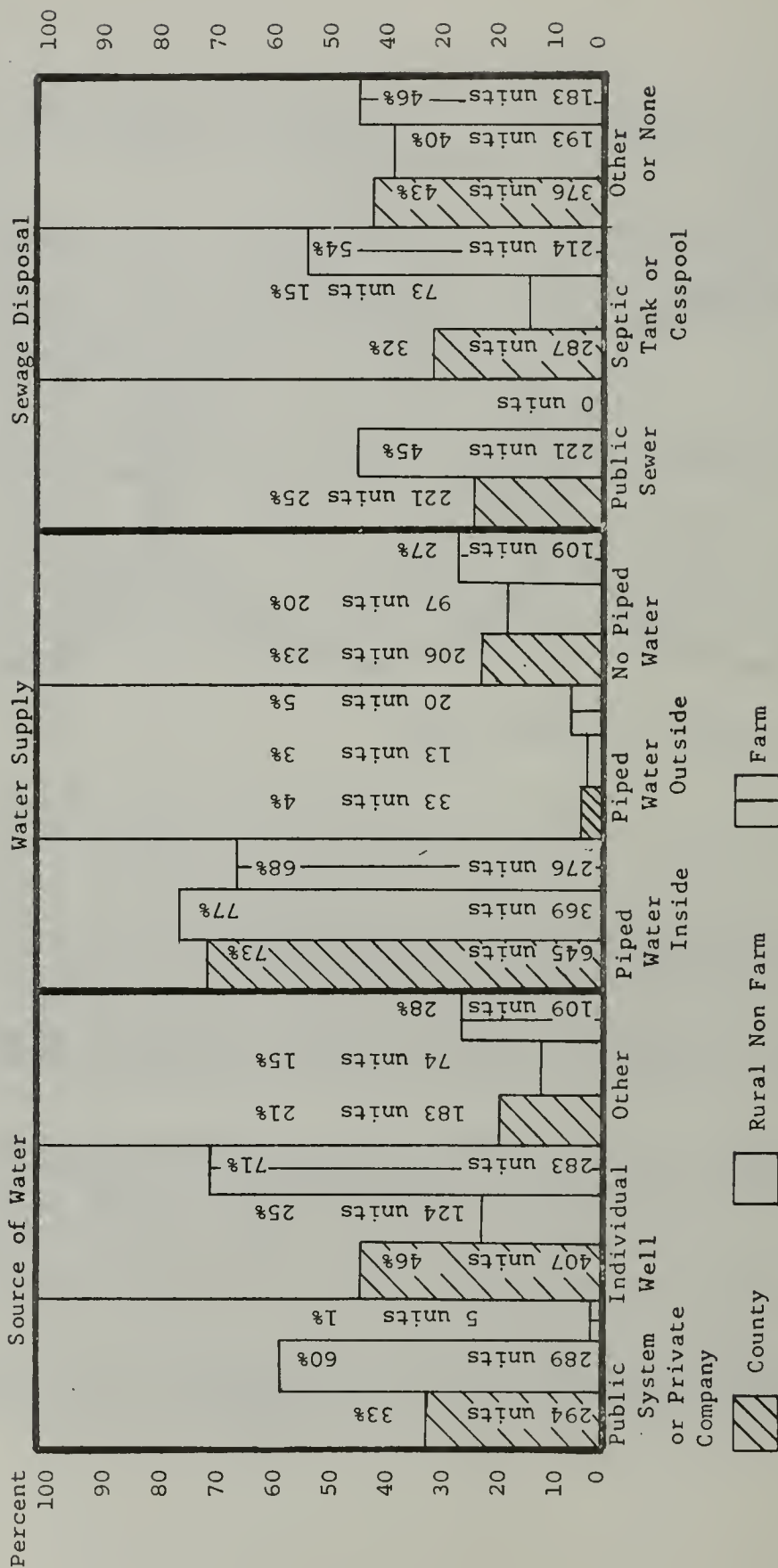
percent of the homes in the rural non farm areas and twenty eight percent of the farms, relied on still another source.

Twenty three percent of all housing units did not have piped water in 1960. This figure included one fifth of the rural non farm housing units and twenty seven percent of all farms.

Only one fourth of the housing units were served by a public sewer. This figure included forty five percent of the rural non farm homes and none of the farms. Septic tanks and cesspools served over one half of the farms and fifteen percent of homes in the rural non farm areas. Just under half of all homes, including forty percent of homes in the rural non farm areas, and forty six percent of the farms, used another method for sewage disposal.

The housing data indicates some deficiencies existed for the rural non farm homes generally located in the small urban areas. Attention is needed in providing facilities for this category of homes.

CHART 9
Sewer and Water
Carter County 1960



Source: U. S. Census of Housing, 1960

THE ECONOMY

Labor

People have a direct relationship on the economy of an area because of their role as both producers and consumers of goods and services. The following economic analysis of Carter County is concerned primarily with the total economic spectrum and how it may affect the future of the area. Changing economic conditions can have either a good or a bad effect in terms of population growth, ability to provide for public improvements, or in determining the general overall living environment.

Carter County reported an eight percent employment and an eleven percent population drop between 1950 and 1960. The loss in the labor force is contrasted with a six percent gain for Montana in the same period.

Past employment change by major industry groups is shown in Chart 10. In the last census period the rate of unemployment stabilized. A seventeen percent drop in male employment and labor force decreased moderately both total employment and labor force. Since the number of women at work increased, their share of jobs was substantially enhanced. By 1960 nearly one out of every four persons at work was a woman.

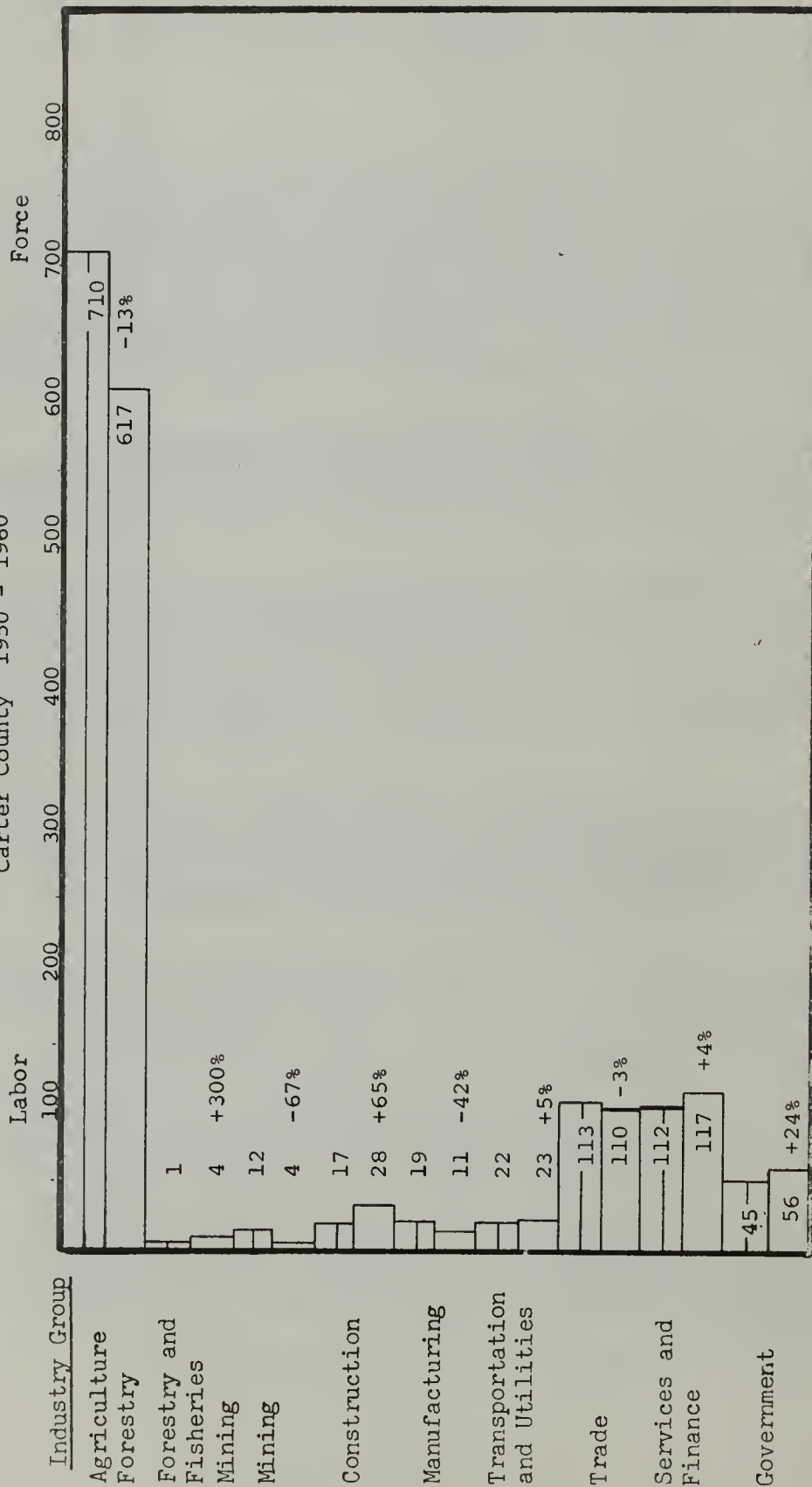
Agriculture clearly represented the major economic industry in the county even though it experienced a thirteen percent drop in labor over the ten year period and thus accounted for most job closings. The remaining industries remained fairly stable over the same time period.

The county relies heavily on other areas for goods and services. It is included within the Miles City and the Belle Fourche, South Dakota marketing areas for the supply of needs and to a lesser extent on Baker for convenience needs.

The reliance on other areas is seen in that there were no professional services available in the county in 1960 and that almost half of the services and finance group represented the school teaching profession.

Percentages for employment by industry group in Table 4 provide an insight into local employment characteristics. The table shows the relative weight of each industry group in the county and offers a comparison with that existing in 1960 for the State of Montana and the United States.

CHART 10
Employment Change by Major Industry Group
Carter County 1950 - 1960



1950 Total Employment 1,064 *

1960 Total Employment 978 *

*Includes Some Industries Not Reported

Source: U. S. Census of Population, 1950-1960

TABLE 4

Percent of Total Employment by Industry Groups
Carter County, Montana and United States
1960

	<u>Carter County</u>	<u>Montana</u>	<u>United States</u>
Agriculture	63	17	11
Forestry and Fisheries	1	1	1
Mining	1	3	1
Construction	3	7	5
Manufacturing	.1	10	27
Transportation and Utilities	2	9	.7
Trade	11	21	19
Service and Finance	12	26	16
Government	6	6	13
Total	100	100	100

Source: U. S. Census of Population, 1960

Nearly two out of three in the labor force were engaged in agriculture in 1960. The local employment rate was almost four times that of the state and six times that of the nation.

The dependency of the county on other areas for supplying goods and services is noted in the employment rates for the trade and the services and finance groups. Both levels were considerably below those for Montana and the United States.

Available labor statistics for 1969 as supplied by the Employment Security Commission indicate a further decrease in the labor force. The only exception occurred in the mining industry which increased by four hundred percent due to oil explorations in the area.

Range livestock production will probably continue as the major economic activity, however, any growth will be moderate. Added oil explorations could further enhance the local economy.

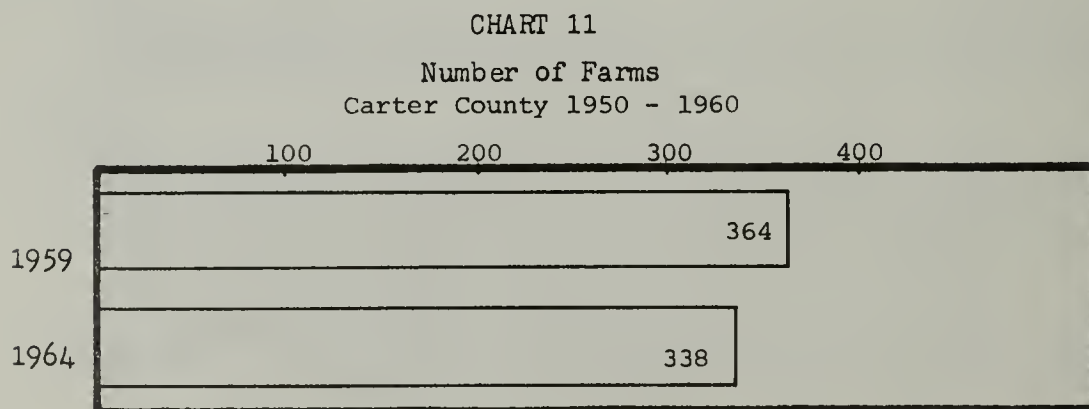
Agriculture

A farm is defined in the United States Census as a place having at least ten acres of land devoted to agriculture and selling at least fifty dollars worth of agricultural products annually. According to Chart 11, there were 338 farms in Carter County in the above category in 1964, seven percent fewer than existed in 1959.

The 1964 classification of farms by type was as follows:

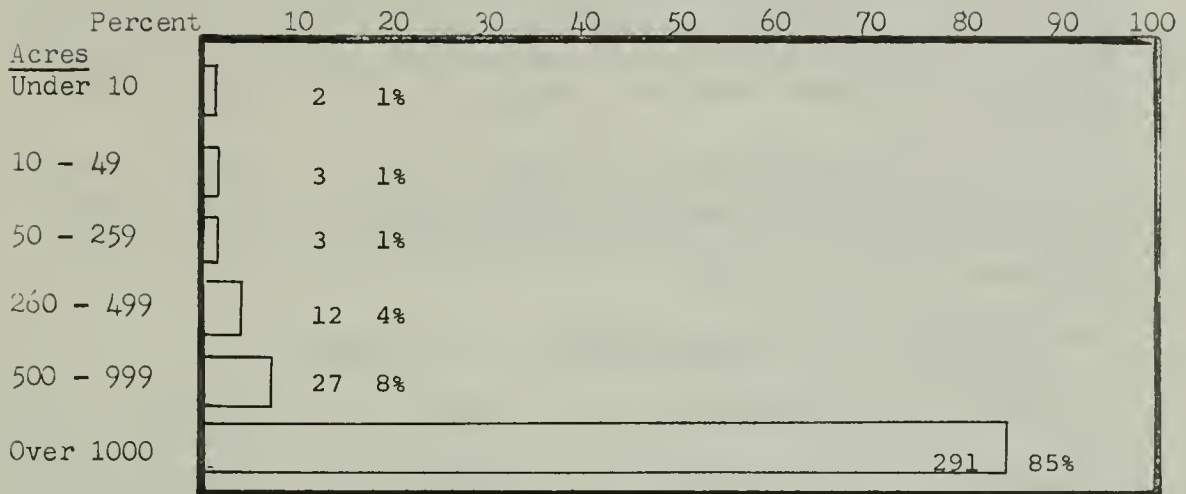
Field crop farms other than vegetables, nuts, and fruit		34
Cash grain	34	
Poultry farms		1
Livestock farms other than poultry and dairy		275
General farms		6
Miscellaneous and unclassified		22
Total		338

Of the total number of farms, nine were classified as part time and eleven were classified as being operated by semi retired persons.



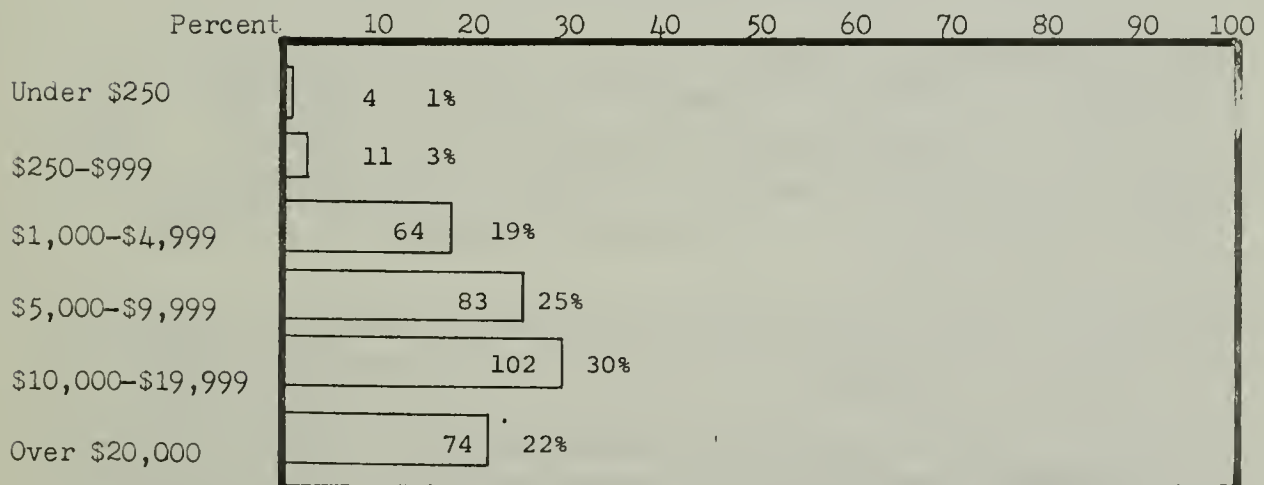
Source: U. S. Census of Agriculture, 1964

CHART 12
Farms by Size
Carter County 1964



Source: U. S. Census of Agriculture, 1964

CHART 13
Number of Farms by Value of Farm Products Sold
Carter County 1964



Source: U. S. Census of Agriculture, 1964

Almost three fourths of all farms in the county were classified as livestock producers. Less than one in ten was engaged in raising field crops. In 1964 the average farm in the county was 4,390 acres in size. Chart 12 indicates that eighty five percent of all farms exceeded one thousand acres while one in fourteen was under five hundred acres.

The value of products sold by the number of farms is shown in Chart 13. Over half of all farms had agricultural sales of over \$10,000 while about one farm in five received in excess of \$20,000. One in four received under \$5,000.

Cash receipts data from 1964 to 1967 is as follows:

<u>Year</u>	<u>Livestock</u>	<u>Crops</u>	<u>Total</u>
1964	\$4,861,100	\$ 839,300	\$5,700,400
1965	\$5,579,700	\$ 733,800	\$6,313,500
1966	\$6,112,500	\$ 807,200	\$6,919,700
1967	\$5,337,500	\$1,034,200	\$6,371,700

More than four out of every five dollars received from the sale of agricultural products during the four year reporting period was derived from livestock products. Because of the dry, flat nature of the land, livestock producing appears to hold the future for the industry.

THE GOVERNMENT

Before any meaningful consideration can be given to major capital improvement projects, it is necessary to study the governmental organizations in Carter County and to analyze their economic structure. At present there are two separate, local governmental units in the county involved within the scope of the water and sewer study. Included is the incorporated city of Ekalaka and the government of Carter County.

A Board of County Commissioners presided over by a chairman governs the county. The incorporated municipalities are governed by a mayor council form of government.

In financing capital improvement projects, the incorporated municipalities have power to bond and raise the necessary monies for funding projects. The unincorporated small towns do not have similar power and, therefore, must rely on financing projects through the county government.

Table 5 indicates the financial condition of each unit of government in 1969.

TABLE 5

Financial Status of County Government and Incorporated Cities

Carter County 1969*

	<u>Revenue</u>	<u>Expenditures</u>	<u>Assessed Valuation</u>
Carter County	\$1,058,333.48	\$1,015,879.84	\$17,278,934.00
Ekalaka	67,245.83	51,855.45	1,434,484.00

* There are several methods presently available to communities for financing water and sewer systems:

1. Incorporated Cities and Towns may use Municipal Bonds, Municipal Revenue Bonds, and Special Improvement District Bonds.
2. Unincorporated Towns may use Rural Special Improvement District Bonds and County Water and Sewer District Bonds.
3. Incorporated Cities and Towns and adjacent unincorporated areas may use Metropolitan Sewer District Bonds.

Source: Information received from each governmental unit

THE WATER RESOURCES

General

The water resources of any area are one of its most important assets. Montana is fortunate in that water is in abundant supply over much of the state. This is especially true in the mountain areas and along the major drainages. Water is essential for many human needs with individual consumption and sanitation being foremost. Industrial and agricultural uses of water are perhaps next most important. The recreational use of water has also become a significant factor in

modern day living.

In his use of this resource, man in the past has polluted much of the available fresh water and degraded it to the point where it is unfit for many or all uses. Careful planning for the efficient use of water resources can avert inconveniences caused by pollution.

Water resources, therefore, are an important consideration in the comprehensive planning for community water and sewer systems. In the following portion of this report the existing water resources of the planning area will be briefly reviewed. The discussion will be specifically concerned with the occurrence and availability of both surface and ground water. Also important, and included in Appendix I, are the specific laws and policies of the State of Montana concerning surface and ground-water resources. "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" adopted by the State Department of Health are discussed in detail. Table A in Appendix I outlines present day water quality standards as set forth by the United States Health Service.

Surface-water Resources

Carter County has an extensive drainage system which has primary characteristics of plains and foothill topography. Drainage may be found flowing in almost any direction; however, the main drainage pattern is to the north and east.

Elevation differences are not excessive, and the complex surface drainage system is attributed to the extremely hilly topography. In general, the highest elevations occur among the forested hills of north central Carter County and the lowest elevation, less than three thousand feet above sea level, occurs where O'Fallon Creek leaves the county northwest of Ekalaka. The highest elevations in the county are 4,215 feet in the Chalk Buttes southwest of Ekalaka and 4,130 feet on Capitol Rock southeast of Ekalaka. The timbered areas south and east of Ekalaka are included in the Custer National Forest.

The major drainage feature of Carter County is the Little Missouri River which enters Carter County at Alzada and flows north northeast across the corner of the county before entering South Dakota near Capitol. The Little Missouri River provides drainage for all of Carter County except the extreme western edge of the county which drains into the Powder River drainage. Important tributaries of the Little Missouri River in Carter County are Box Elder Creek and Little Beaver Creek. Box Elder Creek heads in southwestern Carter County and flows northeast across the county before entering South Dakota east of Ekalaka. Little Beaver Creek also heads in Carter County and

flows northeast through Fallon County before entering North Dakota southeast of Baker.

The above streams provide a yearlong source of water for irrigation, livestock, and domestic needs. These streams, the Little Missouri River, Box Elder Creek, and Little Beaver Creek, have gaging stations installed by the United States Geological Survey (U. S. G. S.) where flow measurements are taken and recorded at regular intervals. Table 6 includes available data on the drainage area, discharge, and runoff for these gaging stations.

Many small reservoirs add significantly to the agricultural and especially the irrigational use of water in the county. As is the case in most counties in Montana, there are no records for small reservoirs published by the U. S. G. S. The Montana Water Resources Board, however, has compiled and published a list of reservoirs which store fifty acre feet or more of water. Where information was available, data for privately owned dams and reservoirs was also included. Information on the irrigation facilities and surface water uses in Carter County can be obtained from the "Water Resources Survey" published by the Montana Water Resources Board in June, 1960. This publication can be obtained from the Water Resources Board in Helena, Montana.

The climate does not have the extreme variable pattern common to the more mountainous western counties of Montana. Precipitation averages vary across the county with the highest averages being recorded along the higher elevations in north central Carter County. For instance, averages at the higher elevations have been estimated at eighteen to twenty inches per year; whereas, averages at lower elevations range from 13.27 inches per year at Ekalaka to 14.42 inches at Alzada. Also, Bell Tower and Ridgway in central Carter County have recorded annual averages of 11.92 and 11.42 inches respectively. It is important to note, however, that the majority of the annual precipitation falls during the growing season of April through September.

In general, precipitation occurs as heavy rain in the spring months of April through June, intermittent showers throughout the summer and early fall months, and as snowfall during the winter months. The snowfall is generally light and does not tend to remain on the ground for long periods of time. Winter warming spells producing thawing temperatures throughout the county are not uncommon.

The use of surface water is widespread for agricultural and recreational purposes. The irrigation summary of Carter County included in the "Water Resources Survey" published by the Water Resources Board in 1960 indicates that at that time over 44,000 acres were being irrigated in Carter County. As is the case in most counties in

TABLE 6

Stream Gaging Stations

Stream	Gaging Sta. Location	Drainage Area (Sq Mi)	No of Stations	Discharge (cfs)			Years Averaged	Runoff-(1000 Acre-Ft)			
				Max.	Date	Min. Date		Max.	Date	Min.	Date
1. Little Missouri River	At Alzada	600	2	3,360	3/27/06	No Flow	At Times	67.5	1906	57.6	1905
2. Little Missouri River	Near Alzada	780	1	6,000	4/4/44	No Flow	At Times	235.5	1944	3.55	1931
3. Box Elder Creek	Near Webster	1092	1	7,340	5/9/67	No Flow	At Times	123.2	1967	3.31	1961
4. Little Beaver Creek	Near Marmarth No. Dak.	587	1	12,700	4/6/52	No Flow	At Times	84.62	1952	2.28	1961

Source: "Water Resources Survey", Carter County, Montana
 Montana Water Resources Board, Helena, Montana, 1960

Notes: 1. Irrigation diversions occur above these stations
 2. Only short term or seasonal records available

* Not Recorded

eastern Montana, a potential exists for the irrigation of many additional acres. Also important is the use of surface water for recreational purposes. The ponds, reservoirs, and streams in the county are ideal habitat for fish and waterfowl and draw many sportsmen to the area each year.

Water Use Classifications

The Water Pollution Control Council has classified the streams and drainages in Montana according to the water use classification definitions shown in Appendix I. The streams and drainages of Carter County and surrounding areas are classified as follows:

Yellowstone River drainage from the Billings water supply intake to the North Dakota line except the tributaries listed below:	B-D ₃
--	------------------

Pryor Creek drainage	B-D ₁
----------------------	------------------

Big Horn drainage above but excluding William's Coulee near Hardin	B-D ₁
--	------------------

Big Horn drainage from and including William's Coulee to the Yellowstone River except the Little Big Horn listed below:	B-D ₂
---	------------------

Little Big Horn drainage above and including Lodge Grass Creek near Lodge Grass	B-D ₁
---	------------------

Remainder of the Little Big Horn drainage	B-D ₃
---	------------------

Tongue River (mainstem) from Tongue River Reservoir to but excluding Prairie Dog Coulee	B-D ₂
---	------------------

Remainder of the Tongue River drainage	B-D ₃
--	------------------

Fox Creek drainage near Sidney	B-D ₂
--------------------------------	------------------

Little Missouri and Belle Fourche Drainages:

All waters	B-D ₃
------------	------------------

Ground-Water Resources

Ground water is used extensively in Carter County for stock and domestic purposes. In much of the county the only source of water is from wells. As of January 1970, 752 appropriations for wells and 267 appropriations for springs were on file with the Montana Bureau of Mines and Geology for Carter County. A total of 598 wells were appropriated for stock use, forty six for domestic use, ninety five for both domestic and stock, four for irrigation, and nine for various other purposes. A total of 219 springs were appropriated for stock use, two for domestic use, thirteen for both stock and domestic use, three for irrigation, and three for public supply; the uses for twenty seven springs were not reported. The town of Ekalaka obtains water for municipal use from four drilled wells. (See Table 7 for chemical analyses of three of these water supplies.)

Technical information on the water resources of Carter County is lacking except for general reconnaissance work done by Dr. E. S. Perry, formerly chief geologist for the Montana Bureau of Mines and Geology. References to Perry's work are as follows: Perry, E. S., 1931, Ground water in eastern and central Montana: Montana Bureau of Mines and Geology Mem. 2, 59 p.; Perry, E. S., 1934 Ground water resources map of Carter County, Montana: Montana Bureau of Mines and Geology, map only; Perry, E. S., 1935, Geology and ground-water resources of southeastern Montana: Montana Bureau of Mines and Geology Mem. 14, 67 p.

Sediments were deposited in Carter County for a long period of geologic time, interrupted only by minor uplift and erosion, until the close of the Cretaceous age (65 to 135 million years ago). Major structural upheaval at the close of Cretaceous time or at the beginning of the Tertiary age (one to 65 million years ago), created a structure in the sediments of the southern three fourths of Carter County known as the Black Hills uplift. The Black Hills of South Dakota were formed by this uplift, and the structure in Carter County is the nose, or the northern end, of this structure. After the period of major upheaval, deposition of sediments resumed and generally has continued to the present time.

Geologic formations that are exposed at the ground surface in Carter County include alluvium of Recent geologic age (less than twenty thousand years old); terrace gravels of Late Tertiary age (one to fourteen million years old); the Arikaree, White River, and Fort Union Formations of Tertiary age (one to 65 million years ago); and Hell Creek, Fox Hills, Pierre Shale, and other shale formations of the Colorado Group, all of Cretaceous age (65 to 135 million years old).

Recent alluvium is present in parts of the valley bottoms formed by

Box Elder Creek, and Little Missouri River, and their tributaries. Many wells in Carter County produce water from the alluvium, which consists of unconsolidated mixtures of clay, silt, sand, and gravel. The thickness of alluvium is unknown, but it probably averages between twenty to thirty feet in depth. The quality of water probably varies from good to poor.

TABLE 7

Chemical Analysis of Municipal Water Supplies
(All Figures in Milligrams per Liter)*

<u>City or Town</u>	<u>Ekalaka</u>	<u>Ekalaka</u>	<u>Ekalaka</u>
Source	Well #2	Well #3	Well #4
Date	3/54	12/66	12/66
Total Solids	745	410	480
Hardness	20	0	0
Ca	4	0	0
Na+K	276	176	202
CO ₃	36	0	9
HCO ₃	404	375	412
SO ₄	206	62	74
Cl	7	6	5
NO ₃	4.4	0.0	0.0
F	0.2	0.4	0.4
Fe	0.2	0.00	0.55
As	Trace	0.00	0.00
Pb	0.01	0.00	0.00
Cu	0	0.00	0.00
Zn	-	-	-
Mg	3	0	0

* See Appendix I, Table A, for accepted water quality standards

Source: State Department of Health, Helena, Montana

Remnants of gravel terraces in the county are too small and scattered to be of importance to the ground water of Carter County. Locally, terrace deposits of unconsolidated or semiconsolidated mixtures of silt, sand, and gravel may yield small amounts of good to fair quality water for domestic or stock use.

The Arikaree and White River Formations of Tertiary age cap the Ekalaka Hills near Ekalaka, the Long Pine Hill, the Sheep Mountains, and some other local areas of high relief in east central Carter County. The Arikaree and White River consist of light colored sandstone and shales and light pinkish gray to greenish gray, impure limestone. The lower portion is considered to be a part of the White River Formation, and the upper portion is considered to be a part of the Arikaree Formation. In general, these sediments are poorly cemented and crumble readily to a sandy or clayey sand, although some of the more sandy layers are quite resistant and form nearly vertical cliffs. These formations are quite dissected, and most of the sandstones are drained or form intermittent springs where they are exposed on hillsides. Locally, wells penetrating these sandstones may yield small quantities of fair to good quality water. Maximum combined thickness of the White River and Arikaree Formations is reported to be 375 feet.

The Fort Union Formation of Tertiary age, which underlies the Arikaree and White River, is exposed at the ground surface over much of northern Carter County. The Fort Union Formation consists of about 1,254 feet of alternating beds of sandstone and shale with occasional seams of coal. As mapped in Carter County, the Fort Union is composed of two members, the Tongue River Member (upper unit) and the Lebo Shale Member (lower unit). Sandstones of the Tongue River Member that lie below the water table are known to produce adequate quantities of good to fair quality water for stock and domestic use. The Lebo Shale Member, which is the lower 150 to three hundred feet of the Fort Union Formation in this area, is not a good aquifer (water yielding material) because it consists mostly of shale. Water obtained from sandstone lenses in the Lebo is likely to be very poor in quality.

The Hell Creek Formation of Cretaceous age, which underlies the Fort Union Formation, is exposed at the ground surface in a semicircular band across Carter County and along the western boundary of the county. As mapped in Carter County, the Hell Creek Formation consists of four hundred to five hundred feet of somber colored, soft shale, brown shale, and gray sandstone, with thin lignite coal lenses in the upper part. The Hell Creek is an important source of ground water in northern Carter County and will usually yield adequate supplies of soft, fair quality water for stock and domestic use. Locally, the water may be highly mineralized.

Below the Hell Creek Formation lies the Fox Hills Formation of Cretaceous age. The upper forty to eighty feet of the Fox Hills is usually a massive, resistant marine sandstone named the Colgate Sandstone Member. In many places in eastern Montana a sandstone exists at the base of the Hell Creek. This sandstone is in contact with the Colgate Sandstone Member, and together they make a relatively thick

and continuous aquifer. The lower fifty to one hundred feet of the Fox Hills is unnamed as a unit and consists of alternating shale and shaly sandstone. The Fox Hills Formation, like the Hell Creek, is an important source of soft water for stock and domestic use in northern Carter County. Locally, the water from the Fox Hills may be highly mineralized. The Fox Hills is exposed at the ground surface in a narrow, semicircular band across central Carter County and along the western border of the county.

Beneath the Fox Hills Formation lies 3,500 to 4,500 feet of dark dense marine shales of Cretaceous age. These are the Pierre Shale and the shales of the Colorado Group. These Cretaceous shales are exposed at the ground surface over most of the southern half of Carter County. These shales are a poor source of ground water. Water obtained from sandstone lenses in these formations is most likely insufficient in quantity and of very poor quality for either stock or domestic use.

The Dakota Formation, which lies below the Cretaceous marine shales, lies below the ground surface in all parts of Carter County. The Dakota Formation rises to the surface in Wyoming, about ten miles south of Alzada, Montana. The Dakota Formation, composed of the Dakota Sandstone at the top and the Lakota Sandstone at the base, is about 250 feet thick. In the valley of the Little Missouri River near the Montana-Wyoming border, the Dakota Formation is about eight hundred feet below the ground surface. The Dakota dips downward from the Montana-Wyoming border toward the north at a rate of two hundred to four hundred feet per mile. In central Carter County the Dakota should lie at a depth of three thousand to four thousand feet below the ground surface. The Dakota is one of the best water bearing formations in the Black Hills region and yields water to thousands of flowing wells in North and South Dakota. The Dakota Formation should yield abundant quantities of good to fair quality water to wells for stock and domestic use. However, in central and northern Carter County the Dakota is too deep lying to be an economical source of domestic water.

The sediments lying below the Dakota Formation are too deep lying in Carter County to be important to the county's water resources.

In summary, the important water bearing formations in Carter County are Recent alluvium; the Tertiary Fort Union Formation; and the Hell Creek, Fox Hills, and Dakota Formations of Cretaceous age. Ground water is extensively used in Carter County for stock and domestic uses, and in most situations the only source of water is from wells. Technical data on the ground-water resources is lacking, and detailed hydrogeologic investigations must be conducted to determine if adequate supplies of suitable quality water are available for possible industrial or irrigation developments and to assist Carter County in

the proper development of its ground-water resources.

- Sources:
1. M. K. Botz, Montana Bureau of Mines and Geology, Butte, Montana, 1970
 2. State Department of Health, Helena, Montana
 3. U. S. G. S. Water Supply Papers and "Surface Water Records of Montana"
 4. "Water Resources Survey," Carter County, Montana Montana Water Resources Board, Helena, Montana, 1960

THE SOILS

General

General descriptions of soils in specific areas are useful in predicting the potential problems which might be encountered during private and public works construction. Carter County has an interesting and somewhat complex geologic history which has influenced the soil structure of the area. The dominating physiographic features of the county are the characteristic land forms of plains topography; however, somewhat rugged topography such as breaks along the stream drainages and relatively high buttes are not uncommon.

Erosion by wind and water over long periods of time has produced the land forms which are characteristic of Carter County. The soils of Carter County were derived from parent materials originally located in the valleys and the adjacent rolling hills, benches, and breaks. The parent materials, which consist primarily of sedimentary rocks, were eroded, transported, and deposited by the extensive drainage throughout the area, and the result has been the filling of many stream valleys with alluvium. The soils of Carter County are made up of the alternations of the alluvium and other bedrock parent materials due to various conditions of climate, topography, and living organisms.

Soil Map

The Soil Conservation Service of the United States Department of Agriculture is currently engaged in a detailed soil study of each county in Montana in an effort to produce general soil maps for each county. The overall detailed study for Carter County is not complete

at this time, and a general soil map is not available. Until the detailed soil survey in Carter County is complete, detailed soil information for specific areas gathered during the preparation of the general soil map can be obtained from the Soil Conservation Service office in Ekalaka or the area office in Miles City. It is recommended that all of the available soil information be consulted during the planning of proposed public works projects in Carter County. Also, on site soil investigations should be performed. The soil scientists of the Soil Conservation Service can offer valuable assistance in interpreting the characteristics of specific soils for different uses, and these services should be utilized.

A valuable source of information for general soils data in the State of Montana can be found in a bulletin entitled "Soils in Montana" by A. R. Southard, an assistant professor of soils at Montana State University in Bozeman. The report was published in February, 1969, and was numbered Bulletin 621 by the Montana Agricultural Experiment Station, Montana State University, Bozeman. The work was completed with the cooperation of the Soil Conservation Service in Montana. As part of the work done for this publication, a general soil map for the entire State of Montana was prepared. The portion of the state map which covers Carter County designates just two general soil areas. The Carter County portion of the map is reproduced in this report as Map 4. In developing this map, the Soil Conservation Service made field studies and observations which resulted in the designation of two soil associations which represent Carter County. Each soil association, as a rule, contains a few major soils and several minor soils. Soils within an association may differ greatly in short distances, and any one soil may occur in more than one association. Thus, the general soil map does not show the kind of soil at any particular point but shows specific patterns of soils. Soil associations are commonly named for the major soil series which occur within the association. Bulletin 621 contains general descriptions of the soil associations and also brief descriptions of each soil series which combine to make up the associations. The association descriptions for Carter County and the related soil series descriptions are included in this report as follows:

1. Bainville-Tullock-Fort Collins Association. The soils of this association are largely shallow to moderately deep over sandstone, siltstone and shale. Tullock soils are coarse textured; Fort Collins soils medium textured. Included soils are Midway, Thurlow, Chama, Arvada, and Laurel. The soils of this association are used for winter grain and range.

- a. Bainville soils are formed on weakly consolidated sandstone and siltstone. The light brown, platy surface soil is underlain by a blocky silt loam subsoil. These soils are

calcareous throughout. They occur on convex slopes on ridge crests and valley sides of the uplands. Depth to bedrock ranges from four to twenty four inches. Associated soils are Midway, Flasher, Cushman, and Chama.

b. Tullock soils are moderately deep and formed on weakly consolidated sandstone. The dominant textures are sandy loams and loamy fine sands. A thin, brownish gray, fine sandy loam surface soil lies on yellowish brown fine sandy loam subsoil. The substratum is a fine sandy loam to loamy fine sand. They are sometimes underlain by sandstone at twenty four to thirty six inches. Tullock soils occur on undulating to sharply rolling uplands. Associated soils are Bainville, Travessilla, and Flasher.

c. Fort Collins soils are developed on deep unconsolidated material. The gray brown loam surface soil lies on a brown prismatic clay loam subsoil. A lime accumulation occurs at about eighteen inches. These soils occur on nearly level to sloping alluvial fans and terraces. Associated soils are Thurlow, Farland, and Wanetta.

2. Lismas-Pierre Association. These are clay soils over shale. The Pierre soils are deeper than the Lismas soils. They are used mainly for range. Included soils are Vanada and Promise.

a. Lismas soils are developed on shale. These are clay soils that are very hard when dry, and sticky and plastic when wet. They are weakly calcareous and have some gypsum crystals just above the bedrock, which is usually encountered at less than eighteen inches. The topography on which these soils occur is rolling, hilly, and steep uplands. Associated soils are Midway and Pierre.

b. Pierre soils are shallow to moderately deep clayey soils formed on shale. The textures are clay throughout and are very hard when dry. There may be a salt accumulation in the subsoil or substratum. The shale bedrock is encountered at less than forty inches. Associated soils are Lismas, Promise, and Marias.

Conclusions

Indications are that the soils of Carter County have generally been easy to deal with where shallow domestic water wells and individual sewage drainfields have been constructed. The large amounts of alluvium and other surface deposits have been found to be extremely variable in permeability, however. This has had an effect on both the quantity of water available in shallow domestic wells and the

successful operation of individual sewage drainfields. Some areas of extensive clay and silt deposits require special care in the construction and operation of septic tank drainfields.

Construction of municipal water and sewer systems in the various soils of Carter County has not been found to be difficult. Pipeline trench digging in the sands and clays is extremely easy while the coarse gravels can slow operations somewhat. Some bedrock can be expected at normal water and sewer line depths, as indicated in the soil association descriptions. Detailed soil information should be obtained before project planning and construction cost estimating are begun.

- Sources: 1 "Soils in Montana," A. R. Southard, Montana Agriculture Experiment Station, Bulletin 621, Montana State University, Bozeman, Montana, February, 1969
2. U. S. Department of Agriculture, Soil Conservation Service, Ekalaka, Montana

COMMUNITY WATER SYSTEM FACILITIES

General

This comprehensive report covers the overall problems, existing or projected, for Carter County, Montana. The volume of data processed and evaluated and the intent of the report allow only a general analysis of any one system.

The intent of this report is to point out the general needs of each community with the objective that each community may in the future be provided with a safe and adequate water system. The general solutions to overall problems suggested in this report may have to be modified when detailed studies are made. These modifications may be in exact size of parts of a system or in some detailed design variation but will not detract from the overall value of the general information presented.

Basically, the demand for water from community systems is for domestic, fire fighting, and industrial uses. The demand for industrial water supply in small communities has not been extensive in Montana and in most cases will not control the design of community systems. Sufficient water for fire fighting must be considered; however, economic feasibility will usually control the extent of such facilities. In most small communities a system with sufficient

capacity to give high ratings for fire protection would require facilities considerably larger than necessary for domestic purposes. The community might be unable to finance such an improvement; the approach, therefore, has been to propose a system suitable for present domestic needs. These basic facilities can be expanded for more complete service and for higher fire ratings as it becomes economically feasible.

The domestic use of water has increased greatly in recent years. This is partially due to improved economic conditions which make it possible for families to acquire such water consuming appliances as dishwashers, waste disposal units, and automatic washing machines. Water use for beautifying property has also increased. The most essential condition is adequate, safe, and potable water for domestic purposes, and this has been the primary consideration in this study. See Appendix II for further comments on analysis criteria.

Basic Considerations

Communities studied in this comprehensive plan were those with a minimum of five potential users and a maximum population of 5,500. Each community within this category was visited at least once. During these visits the type of water facilities available was examined, and an evaluation of the facilities was made from the standpoint of fulfilling the needs of the residents.

The existing systems were found to be quite varied in their operation, condition, and suitability for serving the needs of the users. The situation in each community was evaluated separately; however, some general classification of the various systems was possible. These are described briefly in the following paragraphs so that the general philosophy of the analysis can be shown.

1. In some communities the homes are quite widespread and few in number. Good water in adequate quantities can be found at reasonable depths, and for such situations, private wells will provide a safe and suitable water system.

2. Many communities have had access to good water from private wells for many years. In some of these communities population is increasing, and the area is becoming more densely settled. As a result, tests for bacteriological quality of well water occasionally indicate that pollution is present. When this occurs, it is usually the beginning of a problem which will continue to worsen. Increasing population and a higher potential for contamination indicate the need for a safe community water facility. The system should be one which will serve the domestic needs of the present residents with provisions

for improvements and expansion as needed.

3. Many communities have enjoyed a central water system for years but have not made annual improvements and replacements. This has resulted in overloaded and antiquated systems. Suggestions for immediate improvements which will fit into an overall replacement program are included in this report.

4. Some communities which have experienced a steady population growth are finding that their water systems are inadequate for present demands and will require enlargement. Population projections and economic trends are used to determine the need for improvements and also to justify the type and extent of proposed improvements.

Carter County

The estimated 1970 population of Carter County is two thousand. Approximately seven hundred, or thirty five percent, of these people are presently served by the central water system in Ekalaka, and the remainder are served by private facilities such as wells and springs. With the addition of a central water system in Alzada by 1990, approximately 590, or 42.2 percent of the population, will have access to central water systems if the schedule of proposed improvements is followed. These figures take into account the predicted steady decline in population in Carter County and its communities during the planning period. It is expected that the remaining county population will live in outlying areas, and the homes will not be close enough together to make central systems feasible.

Ekalaka

Existing System. The estimated 1970 population of Ekalaka is seven hundred. Population projections indicate that this population will decrease steadily throughout the planning period. The area is presently served by a central water system, the layout of which is shown on Map 5.

Water supply for this system consists of approximately 295 gallons per minute (gpm) produced by four wells which produce individually thirty one gpm, twenty four gpm, ninety gpm, and 150 gpm and located as shown on Map 5. The storage for the system is provided by an 95,000 gallon storage tank located northeast of town. The tank is in good condition, and no improvements or alterations are anticipated. The quality of the water obtained from the ground-water sources is good, and no treatment facility has been necessary. The water distribution system consists of four and six inch diameter cast iron and

asbestos cement pipe in good condition.

In general, adequate flows and pressures have been reported throughout the Ekalaka water system, and at the present time the system serves the entire community satisfactorily. The present system is slightly undersized according to the design criteria of this report; however, the water supply available on an eighteen hour pumping schedule exceeds the minimum required by present day standards, and the predicted decrease in population throughout the planning period does not warrant expansion of the present system.

Improvements Next Five to Ten Years. The population of Ekalaka is expected to decrease to 675 by 1975. Ideally, an additional fifty thousand gallons of storage and one hundred gpm of water supply are needed to serve this population. A reevaluation of the population trends of this community during this period will indicate whether the installation of these facilities is justified. During this time it is recommended that the present system be expanded to serve areas not now served and looping of deadend lines will help to improve flow and pressure characteristics in the system. These improvements along with normal system maintenance will insure adequate water supply for the town of Ekalaka throughout the remainder of the planning period.

Alzada

Existing System. The estimated 1970 population of Alzada is fifty five. Population projections indicate that this population will decrease slightly throughout the planning period. The people of Alzada currently obtain their water from individual wells. The wells range from just over twenty feet to over one thousand feet in depth. The quality of the water obtained from the deep wells is good, but the water obtained from the shallow wells is rather poor.

Quantities of water obtained are adequate, and there have been no pollution or contamination problems apparent. Only normal operational problems have been encountered with these individual systems, and there has been no consideration of a central water system.

Improvements by 1990. The population of Alzada is expected to reach forty by 1990. It is expected that individual water supply systems will continue to serve this community adequately during the planning period; however, should the local demand for improved facilities develop during this period, a system as shown on Map 6 would adequately serve the needs. A well capable of producing thirty gpm could be developed at a location within the community, and storage for the system could be provided by an elevated storage tank with a

capacity of ten thousand gallons. An alternate solution would be to provide constant pressure pumping facilities at the well, and thus eliminate the cost of the elevated storage. The system as proposed would be adequate for the needs throughout the remainder of the planning period.

Boyes

Existing System. The sixteen persons who presently reside in this community obtain their water supply from private wells. The population is expected to decrease to five by 1990. It is expected that private wells will continue to provide adequate water supply for this community throughout the planning period. Wells in the area range from 150 to over seven hundred feet in depth, and the quality of the water obtained is good. No pollution or contamination problems have been reported, and it is not believed that any type of central water system is feasible at this time or throughout the planning period.

Hammond

Existing System. The estimated 1970 population of Hammond is eleven. This population is expected to decrease to five by 1990. The people of Hammond presently obtain their water supply from individual wells. These wells range in depth from 150 to over two hundred feet, and plenty of good quality water can be obtained from these depths. No serious contamination or pollution problems have been reported, and there has been no consideration of the construction of a central water supply system. It is not anticipated that improved water supply facilities will be necessary for this community during the planning period, and the use of private wells will be the most suitable means of obtaining water supply.

COMMUNITY SEWER SYSTEM FACILITIES

General

Each use of water adds some material or alters some characteristic enough to change the original quality of the water and often to pollute it. The transportation and dilution of municipal, industrial, and agricultural wastes are important and necessary uses of water; therefore, special emphasis is placed on the control of water pollution from these sources. Some of these wastes can be carried in limited amounts without damage to the resource. Some wastes if

discharged into water courses can make their way into underground aquifers and pollute the ground water so that it is unsuitable for further use.

Pollution by definition and interpretation is a matter of degree. Since it is inevitable that the quality of water will be altered with each use, it is of critical importance to control the degree of pollution.

It is public policy established by the state legislature, to maintain reasonable standards of purity for the water of the state. These standards are to be consistent with the use of these waters, including their use in carrying away the water borne waste products of society. The current Federal Water Pollution Control Act in reference to pollution abatement gives the individual states discretion in assessing the physical and economic feasibility of complying with water quality standards. The "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" of the Montana Water Pollution Control Council for streams and rivers in Montana have been included in Appendix I.

Sewage may be broadly categorized as domestic or municipal waste, industrial waste, and animal or agricultural waste. Animal wastes are usually not involved in community sewage facilities; however, they do constitute a potential source of pollution which must be controlled and prevented from entering streams or other potential water supplies.

Although industrial activity throughout Montana has been limited, the need for control and treatment of industrial wastes is apparent. Industrial wastes vary in quantity and composition as greatly as the products and processes which generate them. They include toxic chemicals, solids carried in suspension, brines, strong acids and alkalies, oils, dyes, floating solids, and the heat generated by industrial processes. Industrial wastes are not found to be a major factor in the design of most community sewage facilities. Where economic projections indicate industrial development, the relationship to loading on domestic sewer systems is considered.

Domestic sewage is the primary consideration of this study and has been the basis for design and analysis. Where particular systems are subjected to loading from industrial sources, a more detailed study will be necessary. The general approaches outlined in "Analysis Criteria" in Appendix III will suffice in practically all cases.

Basic Considerations

There are generally three main methods of sewage disposal. These are septic tanks, mechanical sewage treatment plants, and wastewater stabilization ponds. Local soil conditions, availability of land, and density of population are the basic factors which govern the selection of a particular method.

Many of the smaller communities have relied on individual septic tanks and cesspools for each home to handle sewage disposal. Septic tanks are suitable if the population density is low and if the systems are properly designed and maintained. Overflow from these tanks must drain into the soil and, depending on local soil conditions, may or may not create a problem. There is a limit to the amount of water that even loose granular soil can absorb. Density of population and the length of time the effluent has been entering the soil are factors which indicate whether septic tanks can be suitable for sewage disposal.

When economically feasible, community sewage collection and disposal systems are much more desirable than individual systems. Community systems eliminate the worry of septic tank failure, the danger of well contamination, and the problem of soil saturation. However, it is usually uneconomical to serve a few homes scattered over a large area with a community sewer system.

The type of sewage disposal facilities to be used can generally be determined on the basis of economic factors. Mechanical treatment plants provide an excellent means of sewage disposal although the initial cost, maintenance cost, and power cost are usually high. Wastewater stabilization ponds are an ideal method of sewage disposal and usually are the most economical to construct and maintain.

The Montana Water Pollution Control Council has established the criteria that treatment of domestic and industrial wastes shall be secondary treatment or its equivalent. For domestic sewage, mechanical treatment plants or stabilization ponds, when either is properly designed, constructed, and operated, meet these requirements.

A schedule for completion of secondary treatment facilities by communities across the state has been established by the State Department of Health. The target date is included for individual towns when applicable.

Carter County

In Carter County only the town of Ekalaka is presently served by

community sewer facilities. Approximately seven hundred, or thirty five percent of the county population, are served by these facilities. By 1980 approximately 43.8 percent of the population will have access to community sewer facilities if the proposed expansion program is followed. These figures take into account the projected steady decrease in population of both the community and rural areas of Carter County. It is expected that the remaining population not served by community facilities will live in outlying areas, and the homes will not be close enough together to make central systems feasible.

Ekalaka

Existing System. The 1970 population of Ekalaka is estimated to be seven hundred. Population projections indicate that this population will decrease throughout the planning period. A community sewer system facility is in existence, and the layout is shown on Map 9.

The existing system consists of a collection system made up of six, eight, and ten inch diameter sewer mains and a twelve inch diameter outfall line which discharges into an activated sludge sewage treatment plant located northwest of town. The collection system is in good condition, and the only problems reported with the system have occurred at the sewage treatment plant. The plant was new in 1949 and was designed to handle the sewage from a community of 750 persons. The design capacity of the plant is adequate for this community throughout the planning period; however, it has not been operating properly, and planning is necessary for the renewal of the existing plant or the replacement of the plant by a similar or equivalent treatment facility.

Improvements Next Five to Ten Years. The population of Ekalaka is expected to decrease to 675 by 1975. During this period the wastewater treatment plant should be renewed or replaced by an equivalent facility. Alternate solutions to renewing the existing plant would be to replace the plant with a wastewater stabilization pond with a seven acre water surface area or replacement of the plant with an aerated wastewater stabilization pond which would require the purchase of less land area. Also during this period the collection system should be expanded to serve those areas in the community which are not now presently served by the sanitary sewer system. Following the above improvements to the existing system, only normal maintenance will be required to keep this system in satisfactory operating condition throughout the remainder of the planning period.

Alzada

Existing System. The present population of Alzada is estimated to be fifty five. This population is expected to decrease slightly throughout the planning period. At this time sewage in Alzada is handled by individual septic tanks and cesspools. To this date no serious pollution or contamination problem has been reported. Soil in the area consists of clays and sands, and drainfields installed properly provide adequate drainage. Only normal maintenance problems have been encountered, and no major problems are apparent with the individual sewage systems. Construction of a central sewer system has not been considered; however, if local demand develops for improved facilities this project should be planned and constructed during the planning period.

Improvements Next Five to Ten Years. By 1975 the population of Alzada is expected to be fifty. A community sewer system is proposed, and the layout is shown on Map 10. The system could consist of a collection network made up of eight inch diameter pipe and operating entirely by gravity to a treatment facility provided by a 0.5 acre wastewater stabilization pond constructed along the Little Missouri River northwest of the community. Further study and analysis may indicate the need for a lift facility to serve portions of the community satisfactorily.

Improvements by 1990. The population is expected to decline to forty by 1990; however, the installation of central sewage facilities may avert this decline. The sewer system facility proposed under the five to ten year plan will continue to be adequate for the needs throughout the planning period. No improvement or expansion will be necessary unless a change in population characteristics occurs.

Boyes

Existing System. The estimated 1970 population of Boyes is sixteen. This population is expected to decrease to five by 1990. The people of Boyes currently use individual septic tanks and other means of private sewage disposal. Drainage from septic tank drainfields is good as soil in the area consists of sandy material. Individual means of sewage disposal currently serves this community adequately, and a central sewer system facility is not proposed during the planning period.

Hammond

Existing System. The estimated 1970 population of Hammond is eleven.

This population is expected to decrease to five by 1990. The people of Hammond currently dispose of their sewage through individual septic tanks and pit privies. Soil in the area is clay; however, drainage in properly installed septic tank drainfields is satisfactory. Only normal operational problems have been experienced with these individual systems, and no pollution or contamination problems have been reported. A central sewer system facility is not needed to serve this community at this time, and such a system will not become practical during the planning period unless major problems develop with individual disposal systems.

PREFACE TO MAPS

The following maps have been prepared from several sources. The county maps were prepared from Transverse Mercator Projection Series Maps and Montana Highway Department Maps, Planning and Survey Series. The reduction of the county maps necessary for this publication makes them useful for general reference purposes only.

The town and community base maps used herein are taken from Montana State Highway Commission City and Town Plats prepared from aerial photographs dated 1961 to 1969 and have been updated where necessary. On-site surveys, plats obtained from individual towns, and aerial photography conducted in 1970 were also used. Uncontrolled mosaics have been used and scales are, accordingly, only approximate and are shown for referencing purposes only. The mapping operation was supplemented by field checks made during 1970.

Land use information was obtained by field surveys, supplemented and checked by aerial photography during 1969 and 1970.

Water and sewer systems maps show existing facilities for individual towns and communities except where the information was not available. Data concerning these community facilities was obtained from the records of the individual communities and of the State Department of Health. Water and sewer lines are shown in the center of streets to indicate the existence of lines rather than precise locations. The sizes of lines, obtained from the most current information available, are indicated when possible. The locations of recommended improvements are given as relative locations and are not meant to be scaled from the individual town or community maps.

INDEX TO MAPS

Title	Map Number
CARTER COUNTY TOPOGRAPHY	1
STATEWIDE UTILITIES SYSTEMS & RECREATION AREAS	2
CARTER COUNTY LAND OWNERSHIP	3
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EKALAKA SEWER SYSTEM	9
ALZADA SEWER SYSTEM	10

MAP I

COUNTY MAP
GENERAL RELIEF

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

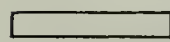
ROADS-HIGHWAYS
———— STATE HIGHWAY U. S. HIGHWAY

----- RAILROADS

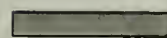
 STREAMS-LAKES

— COUNTY BOUNDARY

----- INDIAN RESERVATION

 0-3,000 FT. ELEVATION

 3-5,000 FT. ELEVATION

 5-7,000 FT. ELEVATION

 OVER 7,000 FT. ELEVATION

MAP 2

LEGEND

MAJOR STATE-WIDE COVERAGE

POWER AND GAS SYSTEMS

-  POWER PLANT (IN MEGAWATTS)
-  1 to 50 KILOVOLTS
-  51 to 100 KILOVOLTS
-  101+ KILOVOLTS
-  PROPOSED LINES
-  GAS LINES

RECREATION AREAS

1. LOST CREEK STATE PARK
 2. LEWIS AND CLARK CAVERNS STATE PARK
 3. LAKE MARY RONAN STATE PARK
 4. MEDICINE ROCKS STATE PARK
 5. ROSEBUD STATE PARK
 6. ROCK CREEK STATE PARK
 7. MAKOSHIKA STATE PARK
 8. WEST SHORE STATE PARK
 9. WOODS BAY STATE PARK
 10. BITTERROOT LAKE STATE PARK
 11. ASHLEY LAKE STATE PARK
 12. LONE PINE STATE PARK
 13. JAMES KIPP STATE PARK
 14. HOOPER MEMORIAL STATE PARK
 15. HELL CREEK STATE PARK
 16. FINLEY POINT STATE PARK
 17. ELMO STATE PARK
 18. FLATHEAD LAKE STATE PARK
 19. YELLOW BAY STATE PARK
 20. WALSTAD MEMORIAL PARK
 21. THOMPSON FALLS STATE PARK
 22. WHITEFISH LAKE STATE PARK
 23. WAYFARERS RECREATION AREA
 24. TIBER RESERVOIR RECREATION AREA
 25. CLARK CANYON RESERVOIR RECREATION AREA
 26. ENNIS RECREATION AREA
 27. DEADMAN'S BASIN RESERVOIR RECREATION AREA
 28. PAINTED ROCKS RESERVOIR RECREATION AREA
 29. CANYON FERRY RECREATION AREA
 30. LOGAN PARK RECREATION AREA
 31. NELSON RESERVOIR RECREATION AREA
 32. BEAVERTAIL HILL RECREATION AREA
 33. GLACIER NATIONAL PARK
 34. YELLOWSTONE NATIONAL PARK
-  NATIONAL FORESTS

MAP 3

COUNTY MAP LAND OWNERSHIP

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

ROADS-HIGHWAYS

———— STATE HIGHWAY U. S. HIGHWAY

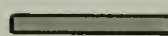
— — — — RAILROADS

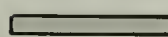
 STREAMS-LAKES

— COUNTY BOUNDARY

 INDIAN RESERVATION

 PRIVATELY OWNED LAND

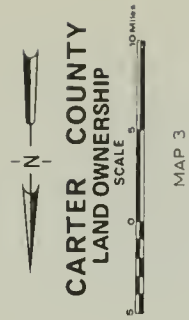
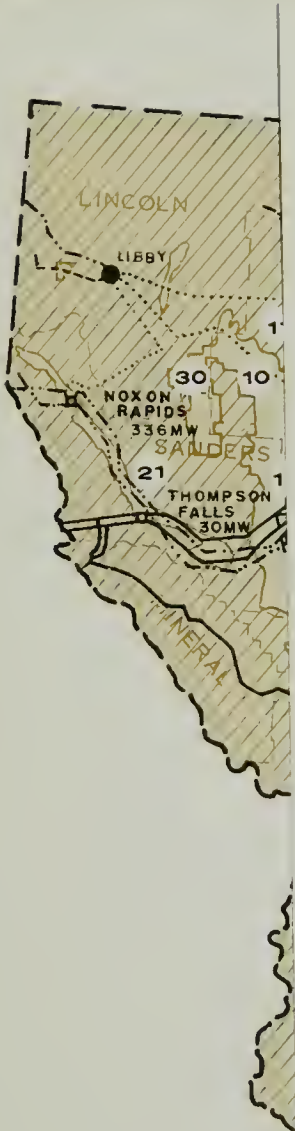
 STATE OWNED LAND

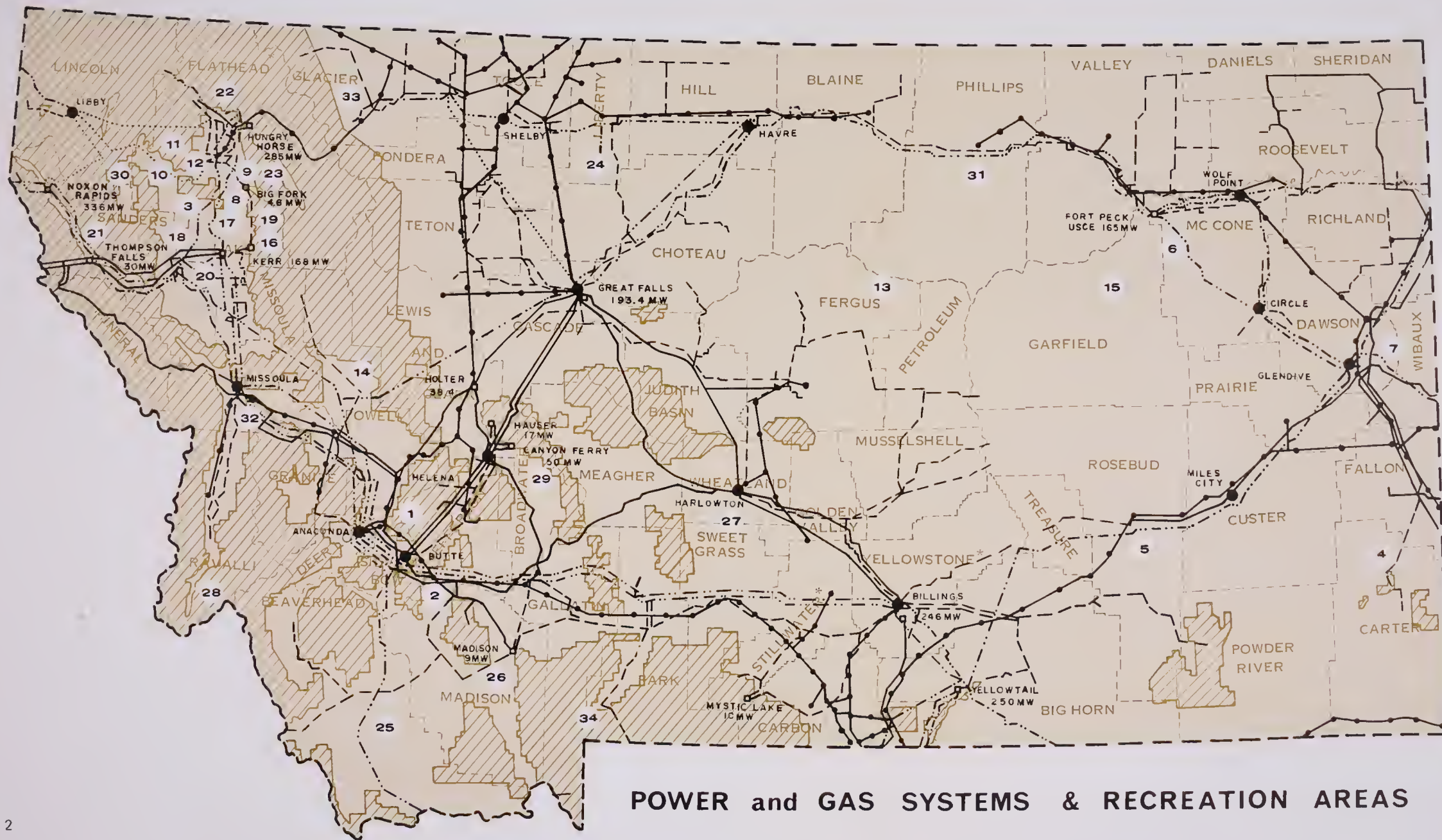
 FEDERAL OWNED LAND

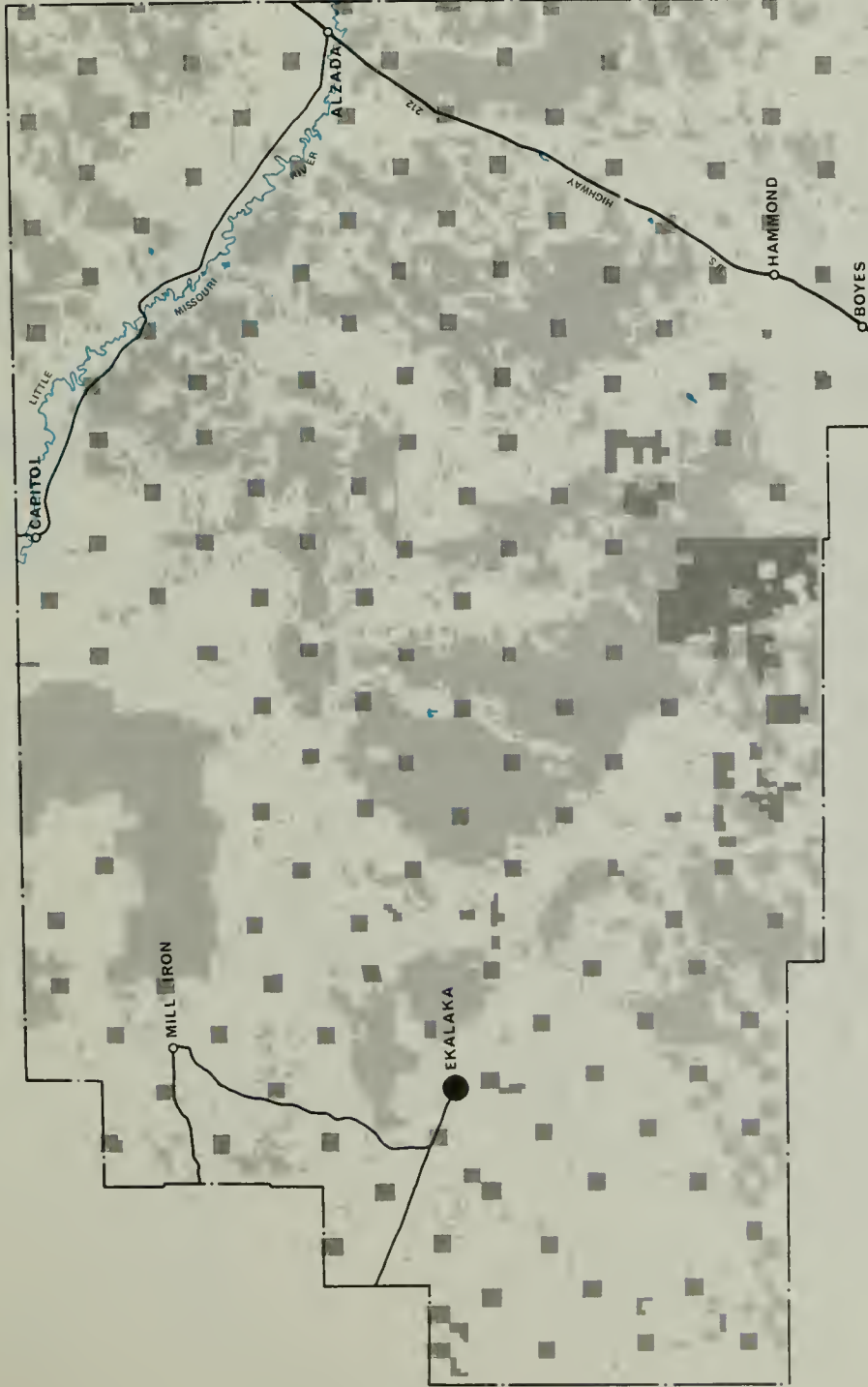
CITIES MAP LEGEND

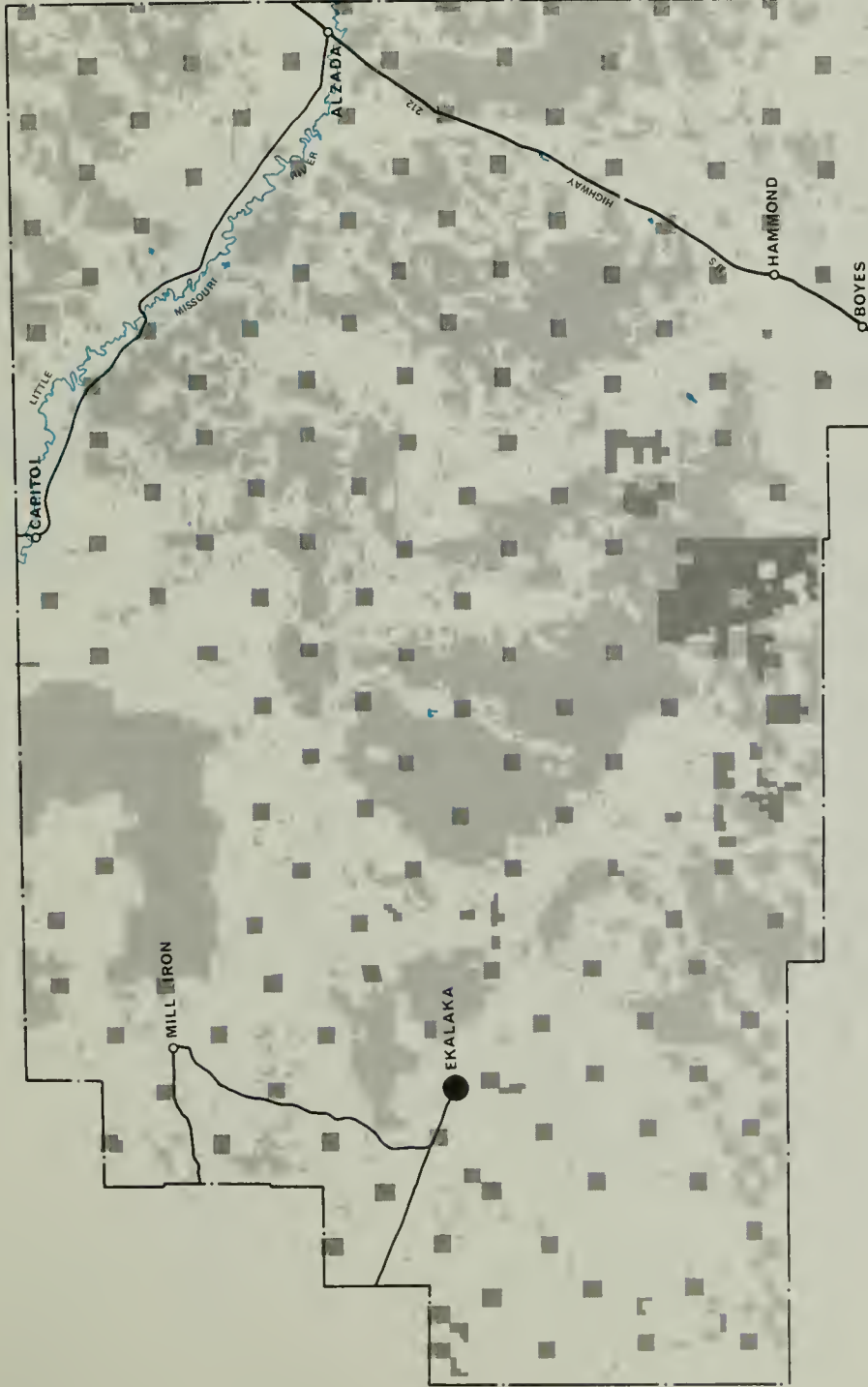
LAND USE	WATER and SEWER SYSTEMS
 SINGLE RESIDENCE	 EXISTING LINES AND SIZES
 DILAPIDATED RESIDENCE	 PROPOSED LINES 5-10 YEAR
 SINGLE TRAILER RESIDENCE	 PROPOSED LINES 10-20 YEAR
 MULTIPLE RESIDENCE	 EXISTING LIFT STATION
 APARTMENTS	 PROPOSED LIFT STATION
 TRAILER COURT	 EXISTING WATER STORAGE TANK
 COMMERCIAL BUILDING	 PROPOSED WATER STORAGE TANK
 HOTEL-MOTEL	 EXISTING WATER SOURCE
 PUBLIC BUILDING	 PROPOSED WATER SOURCE
 SCHOOL	 EXISTING TREATMENT FACILITIES
 CHURCH	 PROPOSED TREATMENT FACILITIES
 HOSPITAL	 SERVICE AREA 1970-1980
 INDUSTRIAL	 SERVICE AREA BY 1990
 GRAIN ELEVATOR	

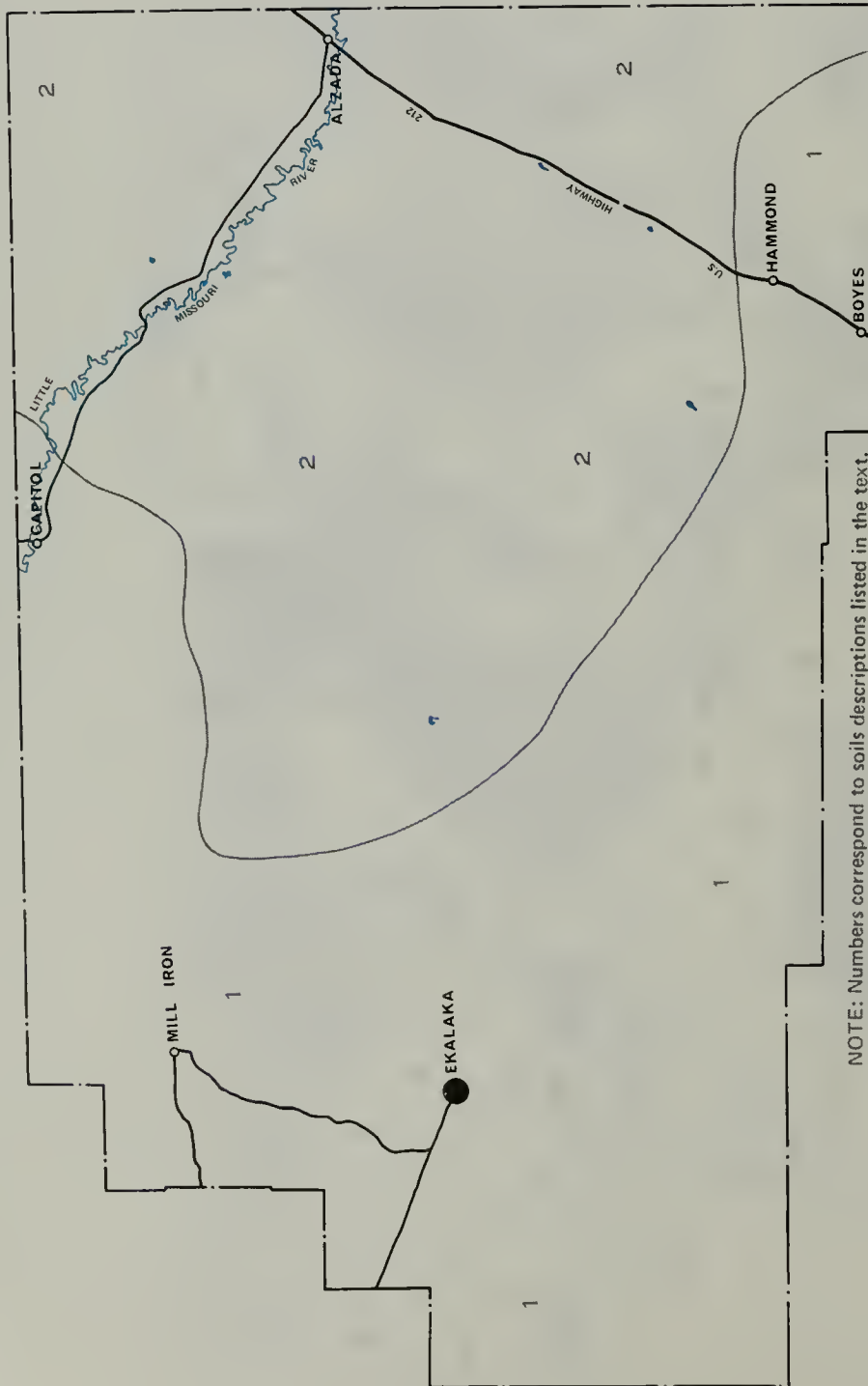
MAP 2



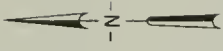






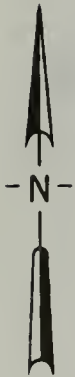


NOTE: Numbers correspond to soils descriptions listed in the text.
SOURCE: USDA Soil Conservation Service

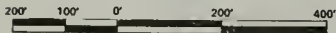


EKALAKA
WATER SYSTEM
SCALE
MAP 5

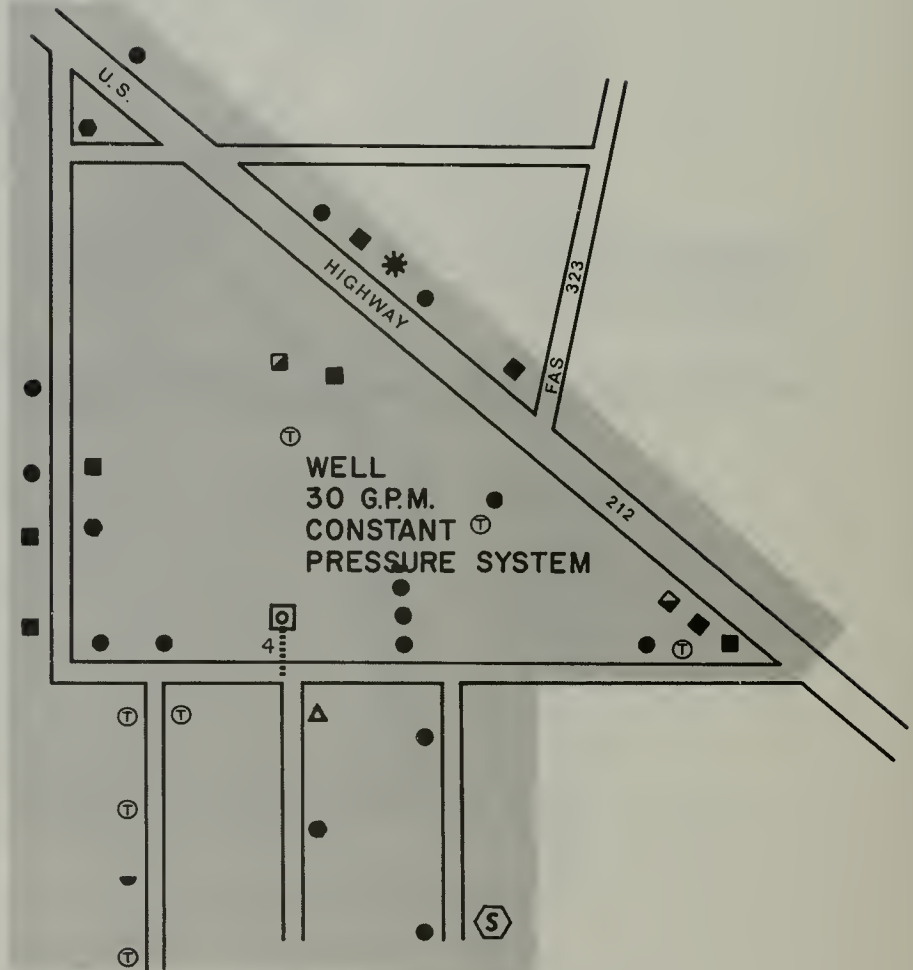




ALZADA
WATER SYSTEM
SCALE

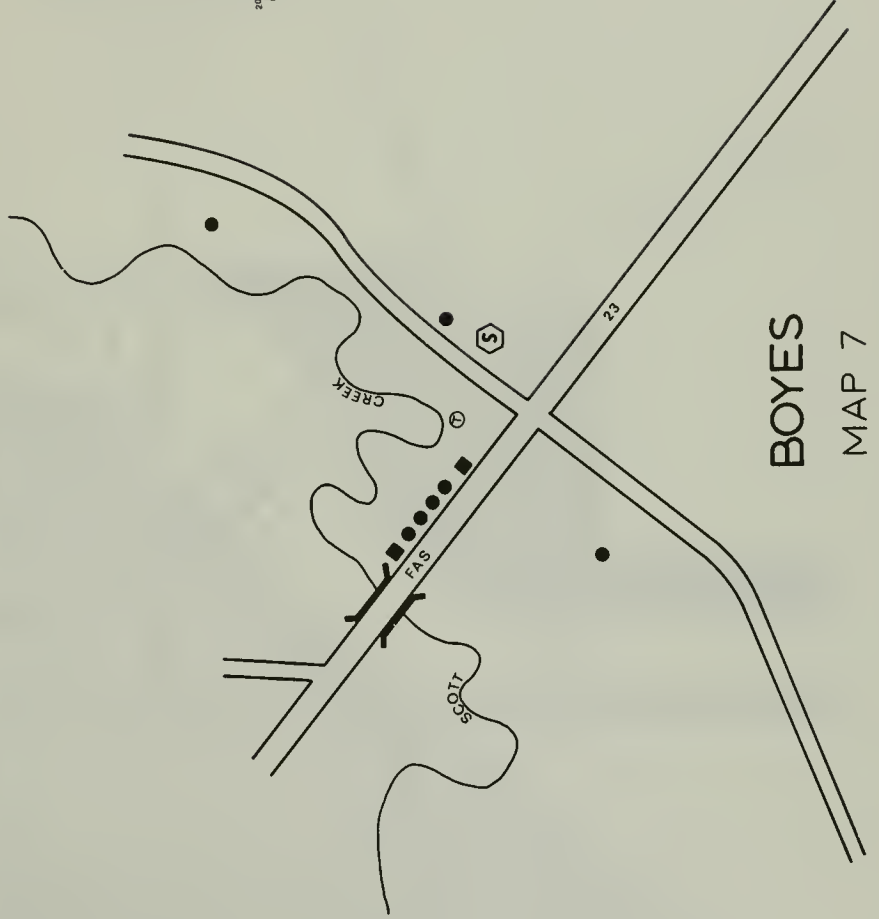


MAP 6

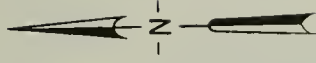




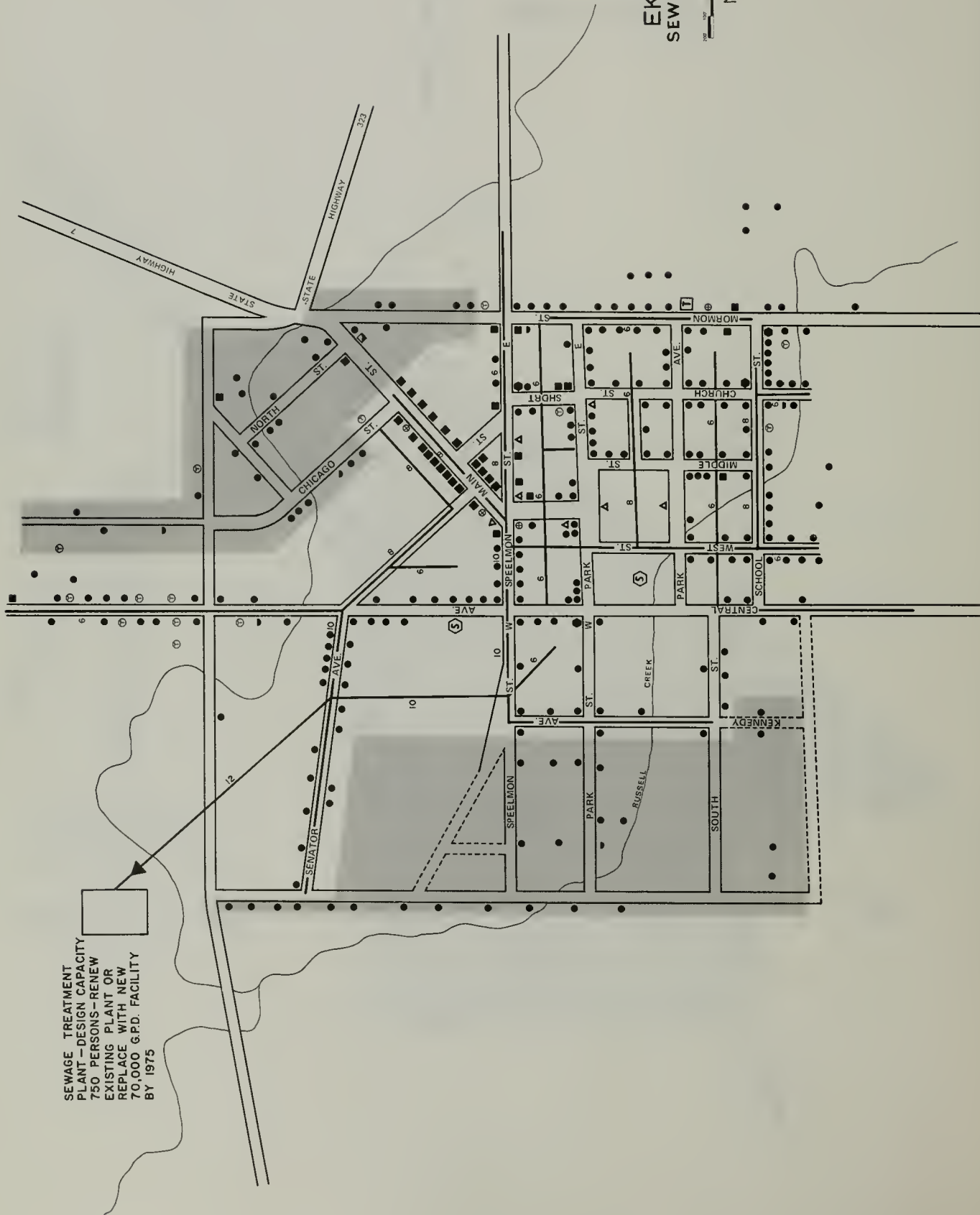
HAMMOND
MAP 8



BOYES
MAP 7



SEWAGE TREATMENT
PLANT—DESIGN CAPACITY
750 PERSONS—RENEW
EXISTING PLANT OR
REPLACE WITH NEW
70,000 G.P.D. FACILITY
BY 1975



EKALAKA SEWER SYSTEM

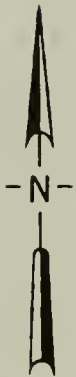
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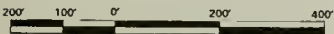
MAP 9

WASTEWATER
STABILIZATION
POND-0.5 ACRES
5-10 YEARS

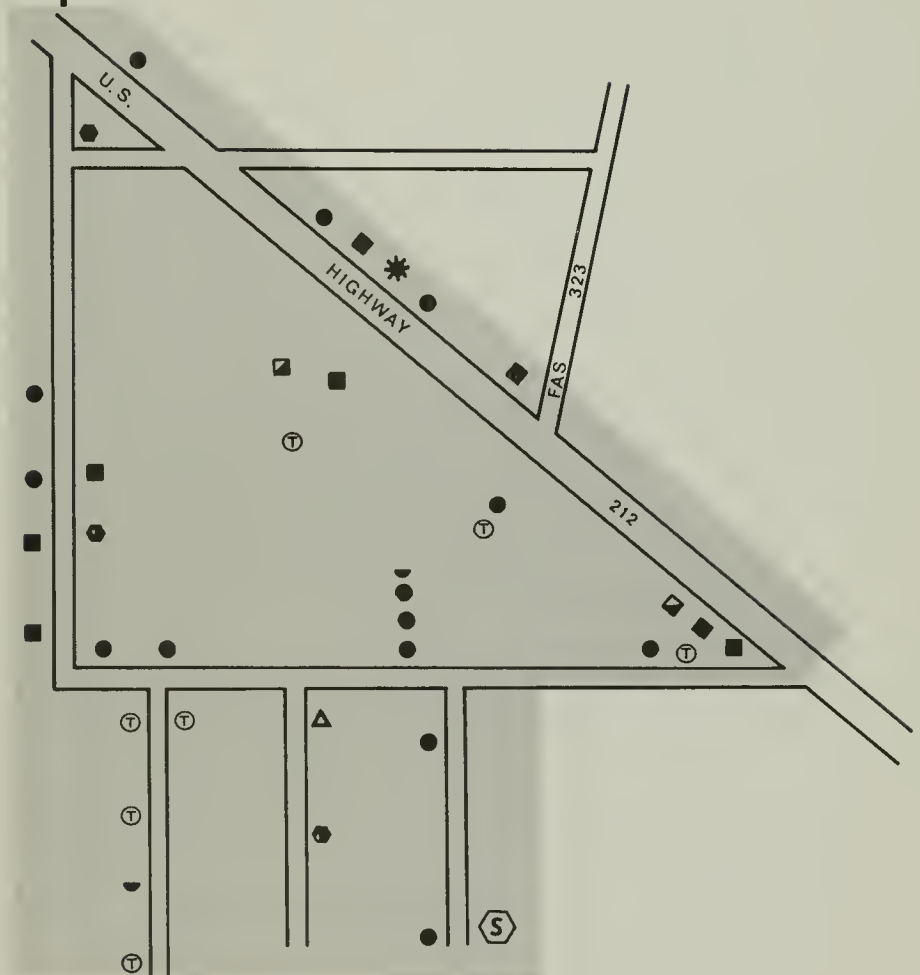
8'



ALZADA
SEWER SYSTEM
SCALE



MAP 10



APPENDICES

APPENDIX I.

MONTANA WATER LAW AND WATER QUALITY CRITERIA

SURFACE-WATER LAW

Two basic laws which concern surface-water rights are recognized in the United States. They are the Doctrine of Riparian Rights and the Doctrine of Prior Appropriation. The Doctrine of Riparian Rights originated in England and is in widespread use in the eastern United States. Basically, this doctrine gives the owners of land bordering a stream the right to have that stream flow past their land undiminished in quantity and unaltered in quality and to use it for household and livestock purposes. Under the Riparian Doctrine, the water is restricted to riparian owners, and it is unlawful for them to reduce significantly the flow of the stream.

It was determined early in the history of Montana that the Doctrine of Riparian Rights was unsuited to the conditions here. First, it was obvious that diversion and reduction of stream flow was a necessity to mining and agricultural uses, and second, much of the land in Montana was under public rather than private ownership. The Doctrine of Prior Appropriation was much more suited to the region and was formally adopted by the Montana Supreme Court in 1921. The appropriation right originated in California where the early gold miners diverted water from streams to placer-mine gold. Water rights were considered in the same manner as mining claims; those who were first in time were first in right and the quantity or size of right was determined by the amount beneficially used.

The five basic points of the Doctrine of Prior Appropriation are:

1. The use of water may be acquired by both riparian and non riparian landowners.
2. It allows diversion of water regardless of the reduction of the water supply in the stream.
3. The value of the right is determined by the priority of the appropriation, i.e., first in time is first in right.

4. The right is limited to the use of the water. Stream waters in Montana are the property of the state and the appropriator acquires only a right to their use. Moreover, this use must be beneficial.
5. A right to the use of water is considered property only in the sense that it can be bought or sold; its owner may not be deprived of it except by due process of law.

No water right may be acquired on a stream in Montana without diversion of water and its application to a beneficial use. The method of acquiring or appropriating a right to water has been outlined by the state legislature. The procedure for appropriation from an unadjudicated stream is:

1. Posting of notice in a conspicuous place at the point of intended diversion stating:
 - a. quantity of water claimed
 - b. use for which water is claimed and place of use
 - c. description of means of diversion
 - d. date of appropriation
 - e. name of appropriator
2. Filing, within twenty days after date of appropriation, of a notice of appropriation with the county clerk including in addition to the posted notice:
 - a. name and description of the stream
 - b. description of point of diversion with reference to a permanent monument or natural marker
 - c. verification by affidavit of the appropriator that facts of the notice are true

Montana laws do not require that a water user file an official record of the completion of an appropriation. It is, therefore, a fact that in many instances the demand

for the water of a stream is much greater than the supply available. In such cases there is a means by which the rights and priorities of each user along a specific stream may be officially determined. The action of adjudication or water right suit may be initiated by any one or more of the appropriators. The Judge of the District Court then examines all of the claims and issues a decree establishing priority of right of each water user and the amount of water he is entitled to use.

The procedure for appropriation of water from adjudicated streams is slightly more complicated than that of unadjudicated streams. For adjudicated streams an appropriator shall:

1. Employ a competent engineer to survey the area and means of conducting water from its source to place of intended use.
2. Have aerial photographs and maps thereon to show the course of the intended diversion or location of intended impoundment.
3. File with the Clerk of the Court of the county of appropriation a petition which includes:
 - a. the amount of water sought by appropriation
 - b. a description of the watercourse or body from which water is intended to be appropriated
 - c. a description of the means of diversion or size, location and manner of construction if a reservoir is intended
 - d. the engineers survey and aerial photographs
 - e. a declaration by the appropriator that the rights sought shall be subject to and bound by any decree theretofore rendered adjudicating the waters or any body to which the waters may be tributary
4. Name all others who have or appear to have rights in the source of supply as defendants in the appropriation proceeding.

Upon completion of the above procedure, a trial is held and normally a decree results. If a new appropriation is granted, the appropriator shall be bound by all prior rights and decrees.

GROUND-WATER LAW

The quantity of ground water stored beneath the surface of the earth in Montana exceeds that on the surface. For many years use of this vast ground-water resource was very limited and no need for regulating its use was deemed necessary. In recent years the use and development of ground-water resources has increased considerably and it was realized that, without some means of regulation, ground water in some areas might be withdrawn at a faster rate than it could be naturally replenished.

In 1961 the 37th Legislative Session of Montana passed a bill which created a Ground Water Code in Montana (Chapter 237, Revised Codes of Montana, 1961). This bill became law on January 1, 1962, and the State Engineer of Montana was designated as the "Administrator."

The Ground-Water Law contains many provisions which are considered pertinent to this comprehensive plan, and, therefore, portions of these provisions will be presented in this report. They are:

Section 1. Definitions or Regulations As Used In The Act.

a. "Ground Water" means any fresh water under the surface of the land including the water under the bed of any stream, lake, reservoir, or other body of surface water. Fresh water shall be deemed to be the water fit for domestic, livestock, or agricultural use. The Administrator, after a notice of hearing, is authorized to fix definite standards for determining fresh water in any controlled ground-water area or sub area of the state.

b. "Aquifer" means any underground geological structure or formation which is capable of yielding water or is capable of recharge.

c. "Well" means any artificial opening or excavation in the ground, however made, by which ground water can be obtained or through which it flows under natural pressures or is artificially withdrawn.

d. "Beneficial use" means by economically or socially justifiable withdrawal or utilizations of water.

e. "Person" means any natural person, association, partnership, corporation, municipality, irrigation district, the State of Montana, or any political sub-division or agency thereof, and the United States or any agency thereof.

f. "Administrator" means State Engineer of the State of Montana.

g. "Ground-Water area" means an area which, as nearly as known facts permit, may be designated so as to enclose a single distinct body of ground water which shall be described horizontally by surface description in all cases and which may be limited vertically by describing known geological formations, should conditions dictate this to be desirable. For purpose of administration, large ground-water areas may be divided into convenient administrative units known as "sub-areas."

Section 2. Right To Use. Rights to surface water where the date of appropriation precedes January 1, 1962, shall take priority over all prior or subsequent ground-water rights. The application of ground water to a beneficial use prior to January 1, 1962, is hereby recognized as a water right. Beneficial use shall be the extent and limit of the appropriative right. As to appropriations of ground water completed on and after January 1, 1962, any and all rights must be based upon the filing provisions hereinafter set forth, and, as between all appropriators of surface or ground water on and after January 1, 1962, the first time is first in right.

Any ground water put to beneficial use after January 1, 1962, must be filed upon in order to establish a water right thereto. Four different types of forms have been provided for filing. The titles of the forms are:

- Form No. 1 "Notice of Appropriations of Ground Water"
- Form No. 2 "Notice of Completion of Ground Water by Means of a Well"
- Form No. 3 "Notice of Completion of Ground Water Appropriation Without a Well"

Form No. 4 "Declaration of Vested Ground Water Rights"

Form No. 1 is optional and Form No. 4 was for those who had put ground water to a beneficial use before January 1, 1962. Again, it is important to recognize that the ground-water law states especially that, "Until a notice of completion (Form No. 2 or No. 3) is filed with respect to any use of ground water instituted after January 1, 1962, no right to that use of water shall be recognized."

WATER QUALITY

The State Department of Health, under the supervision of the State Water Pollution Control Council, is responsible for administering the water pollution laws of the state. As stated in the resume of Montana water laws published by the Montana Water Resources Board, "the Department of Health has supervision over all state waters which are directly or indirectly being used as a public water supply." The Water Pollution Control Council is responsible for classifying water and formulating a program for pollution control.

The Water Pollution Control Council has adopted specific "Water Quality Criteria;" established "Water Use Classifications;" and issued a complete list of "Policy Statements." The original adoption of these standards took place October 5, 1967, and since that time they have been made available to interested persons by the State Department of Health. A portion of the information available from the Department is the detailed chemical, physical, and biological standards of the "Water Quality Criteria" for effluent water. Water quality standards for domestic water, as set forth by the United States Public Health Service, are shown in Table A. The Montana Water Pollution Control Council "Policy Statements" and "Water Use Classifications" are presented in the following paragraphs.

The Water Pollution Control Council has added a new policy statement at the request of the Federal Water Pollution Control Administration. The new statement is:

Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at

the high quality unless it has been affirmatively demonstrated to the state that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of such waters. Any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required to provide the necessary degree of waste treatment to maintain high water quality. In implementing this policy, the Secretary of the Interior will be kept advised in order to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

The originally adopted "Policy Statements" are:

- 1. Quality of waters classified for multiple use shall be governed by the most stringent criteria listed for any use.*
- 2. The Council has classified as "A-Closed" only those waters on which access and other activities are presently controlled by the utility owner. If other uses are permitted by the utility owner, these waters shall be reclassified "A-Open" or lower. Conversely, waters in the "A-Open" classification, if shown to meet the "A-Closed" criteria, may be so classified by the Council at the request of the utility owner. Where "A-Open" water is used for swimming and other water contact sports, a higher degree of treatment may be required for potable water use.*
- 3. The water quality standards are subject to revision (following public hearings and, in the case of interstate streams, concurrence of the Federal Water Pollution Control Administration) as technical data, surveillance programs and technological advances make such revisions desirable. There are waters in the state on which little water quality data is presently available. Water quality criteria for these waters was established to protect existing and future water uses on the basis of the most representative information available.*

In some cases, particularly in eastern Montana, waters have been classified "B" and "C" where the upper ends of the streams will probably be suitable for this use while the lower ends will not. However, not enough data is available to determine where the "B" and "C" designation should be dropped. Whenever a water supply or swimming area is developed, the regulations and the advice of the State Board of Health should be acquired. As time permits, data will be obtained and the classifications reviewed.

- 4. As used in the Water Quality Criteria, the phrases "natural," "naturally present" and "naturally occurring" are defined as conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied. Waters below existing dams will be considered natural.*
- 5. It is the intent of the criteria that the increase allowed (temperature for example) above natural conditions is the total allowable from all waste sources along the classified stream.*
- 6. Although the water quality criteria specify minimum dissolved oxygen concentrations, it shall be the policy of the Council to require the best practicable treatment or control of all oxygen-consuming wastes in order to maintain dissolved oxygen in the receiving waters at the highest possible level above the specified minimums.*
- 7. For treatment plant design purposes, stream flow dilution requirements shall be based on the minimum consecutive seven day average flow which may be expected to occur on the average once in ten years.*
- 8. Where sampling stations and points of mixing of discharges with receiving waters as mentioned in the water quality criteria are to be established on interstate waters, the concurrence of the Federal Water Pollution Control Administration will be solicited.*

TABLE A
Water Quality Standards

Characteristic	Permissible Concentrations in Milligrams Per Liter	Objections to Concentrations Beyond Permissible Limits
Turbidity	5*	Esthetic
Color	15*	Esthetic
Threshold Odor Number	3*	Esthetic
Alkyl Benzene Sulfonate (ABS)	0.5	Taste, Foaming, Indicator of Pollution
Arsenic (As)	0.01	Toxic
Chloride (Cl)	250	Possible Laxative Effect
Copper (Cu)	1.0	Possible Physiological Effect
Carbon Chloroform Extract (CCE)	0.2	Toxicological Interest
Cyanide (CN)	0.01	Toxic
Fluoride (F)	See Below	Mottling of Teeth
Iron (Fe)	0.3	Esthetic, Staining of Laundry
Manganese (Mn)	0.05	Esthetic, Staining of Laundry
Nitrate	45	Methemoglobinemia
Phenols	0.0001	Taste
Sulfates	250	Possible Laxative Effect
Total Dissolved Solids	500	Possible Laxative Effect
Zinc (Zn)	5	Possible Laxative Effect
Radium-226	3**	Radiation Damage
Strontium-90	10**	Radiation Damage
Gross Beta Radioactivity	1,000**	Radiation Damage

Concentrations in excess of following should be re-examined before use (mg/l):

Arsenic (As)	0.05	Fluoride (F)	See Below
Barium (Ba)	1.0	Lead (Pb)	0.05
Cadmium (Cd)	0.01	Selenium (Se)	0.01
Hexavalent Chromium (+6)	0.05	Silver (Ag)	0.05
Cyanide (CN)	0.2		

Annual Average of Maximum Daily Air Temperature	Recommended Control Limits—Fluoride Concentrations in mg/l		
	Lower	Optimum	Upper
50.0 to 53.7	0.9	1.2	1.7
53.8 to 58.3	0.8	1.1	1.5
58.4 to 63.8	0.8	1.0	1.3
63.9 to 70.6	0.7	0.9	1.2
70.7 to 79.2	0.7	0.8	1.0
79.3 to 90.5	0.6	0.7	0.8

Hardness Standards for Water

Hardness in Milligrams per Liter	Degree of Hardness
0 - 35	Soft
36 - 100	Medium
100 - 150	Hard
Over 150	Extremely Hard

* Standard Units.

** Pico-curles Per Liter.

Source: Ameen, Joseph S., Community Water Systems, 1960

9. *It is not the intent of these criteria to provide for a swimming water immediately below an existing treated domestic sewage outfall.*
10. *Where common treatment is practicable, it is the policy of the Council to restrict the number of sewer outfalls to a minimum.*
11. *Tests or analytical procedures to determine compliance with standards will, insofar as practicable and applicable, be made in accordance with the methods given in the twelfth edition of "Standard Methods for the Examination of Water and Waste Water" published by the American Public Health Association, et al., or in accordance with tests or analytical procedures that have been found to be equal or more applicable.*
12. *Because of conflicting testimony, it is the intent of the Water Pollution Control Council to obtain additional information on temperatures and fisheries on waters below existing steam generating stations at Billings and Sidney on the Yellowstone River. This can probably be best accomplished by a cooperative study between the utility, State Fish and Game Department, Federal Water Pollution Control Administration and the Montana State Department of Health.*
13. *Insufficient information is available for establishing fixed sediment criteria at this time. Until standards can be set, reasonable measures, as defined by the Water Pollution Control Council, must be taken to minimize sedimentation from man's activities.*

Minimum treatment requirements set forth by the Council are:

1. *Domestic Sewage – the minimum treatment required for domestic sewage shall be secondary treatment or its equivalent with the understanding that properly designed and operated sewage lagoons will meet this requirement.*

2. *Industrial Wastes – the minimum treatment required for industrial wastes shall be secondary treatment or its equivalent.*

Definitions of the water use classifications assigned to the Columbia and Missouri Basins and the Hudson Bay drainage in Montana are:

"A-Closed" – Water supply for drinking, culinary and food processing purposes, suitable for use after simple disinfection. Public access and activities such as livestock grazing and timber harvest should be strictly controlled under conditions prescribed by the State Board of Health.

The Council has classified as "A-Closed" only those waters on which access is presently controlled by the utility owner. If other uses are permitted by the utility owner, these waters shall be reclassified "A-Open-D 1" or lower.

"A-Open-D 1" – Water supply for drinking, culinary and food processing purposes suitable for use after simple disinfection and removal of naturally present impurities. Water quality shall also be maintained suitable for the use of these waters for bathing, swimming and recreation (See "Note" below), (where these waters are used for swimming and other water contact sports, a higher degree of treatment

Note: Common sense dictates that swimming and other water contact sports are inadvisable with a reasonable distance downstream from sewage treatment facility outfalls.

may be required for potable water use); growth and propagation of salmonid fishes and associated aquatic life, water fowl and furbearers; agricultural and industrial water supply. Therefore, these waters shall be held suitable for "A-Open", "C", "D", "E" and "F" uses but may not necessarily be used for all such purposes.

Waters in this class, if shown to meet the "A-Closed" criteria, may be so classified by the Council at the request of the utility owner.

All waters within the boundaries of national parks and nationally designated wilderness, wild or primitive areas in Montana are classified "A-Open-D₁" except those adjacent to developed areas such as Snyder Creek through the community of Lake McDonald and Swiftcurrent Creek below the Many Glacier Chalet, both in Glacier National Park. Also, Georgetown, Flathead and Whitefish Lakes and Lake Mary Ronan are classified as "A-Open-D₁" as are some streams presently used for domestic water supply.

"B-D₁" The quality of these waters shall be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary to remove naturally present impurities; bathing, swimming, and recreation (see note under "A-Open-D₁"); growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; agricultural and industrial water supply. Therefore, "B-D₁" equals "B", "C", "D₁", "E" and "F".

"B-D₂" The quality of these waters shall be maintained suitable for the uses described for "B-D₁" waters except that the fisheries use shall be described as follows:

"Growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers."

Therefore, "B-D₂" equals "B", "C", "D₂", "E" and "F".

"B-D₃" The quality of these waters shall be maintained suitable for the uses described for "B-D₁" waters except that the fisheries use

shall be described as follows:

"Growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers."

Therefore, "B-D₃" equals "B", "C", "D₃", "E" and "F".

"C-D₂" The quality of these waters shall be maintained suitable for bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; agricultural and industrial water supply. Therefore, "C-D₂" equals "C", "D₂", "E" and "F".

"D₂" The quality of these waters shall be maintained for growth and marginal propagation of salmonid fishes and associated aquatic life, water fowl and furbearers; agricultural and industrial water supply. Therefore, "D₂" equals "D₂", "E" and "F".

"E" The quality of these waters shall be maintained for agricultural and industrial water supply uses and "E" shall equal "E" and "F" uses.

"F" The quality of these waters shall be maintained suitable for industrial water supply uses, other than food processing.

- Sources:
1. "Montana Water Laws: A Resume," Inventory Series Report No. 5, Montana Water Resources Board, Helena, Montana, November, 1968
 2. "Water Resources Survey," Flathead and Lincoln Counties, Montana, State Engineer's Office, Helena, Montana, June, 1965
 3. "Water Quality Criteria," "Water Use Classifications," "Policy Statements," communication from Claiborne W. Brinck, Director, Division of Environmental Sanitation, State Department of Health, Helena, Montana, May 7, 1968

APPENDIX II.

COMMUNITY WATER SYSTEM FACILITIES

ANALYSIS CRITERIA

Complete designs of safe community water systems can become extremely complicated. Each design and analysis is usually a unique problem for that individual system. For this study, a general approach must be used; however, it is realized that a more detailed study may result in somewhat different findings and proposals. The following paragraphs contain a discussion of the approach used in arriving at general design criteria used herein.

In the analysis and design of water systems, the interrelations of supply, transmission, storage, and distribution must be considered. For example, if the water supply is not adequate to meet the peak hourly demand, storage is necessary to provide a reserve for the peak periods. The size of the various portions of the system is determined by establishing the average daily demand on the system.

The determination of daily water consumption is arrived at by considering records of existing systems. Usage varies over a wide range of about one hundred gallons per capita per day (gpcpd) to six hundred gpcpd. Usages of four hundred gpcpd are very common during hot weather. The basis of analysis used, herein, is two hundred gpcpd average. The accepted nationwide average daily demand value for a community water system is 125 gallons per day per person for domestic use. Records show that practically all Montana communities exceed this amount especially during hot weather, and the two hundred gpcpd is more in line with present day demands for communities in Montana.

Well capacities and capacities of other sources of supply must be sufficient to provide water for the average requirements and additional amounts to sustain peak periods. It is felt that a water source capable of supplying the total average daily demand by operating for a twelve hour period is a suitable basis for analysis. This means that the average daily demand doubled,

divided by twenty four hours per day and sixty minutes per hour, will result in a required rate of supply in gallons per minute. It is realized that this source may be required to operate more than twelve hours during high demand periods. This freedom in operation, combined with storage facilities, is intended to provide the necessary flexibility to handle low and high demand periods economically.

It is common practice to provide storage facilities with capacity equal to the supply necessary for one average day. This will provide storage for fire protection and any excess will add to the flexibility of the system. Table B shows desired storage for fire based on population. This information corresponds to requirements of the Montana Fire Rating Bureau and is taken from "Community Water Supplies" by Ameen.

During certain times of the year water consumption will exceed the average figure of two hundred gpcpd. The system analysis must be checked to determine the amount of water actually available to supply such demands. The estimated 1990 population is used for this check so that population increases are considered. Also, it is expected that the source will have to operate for more than the twelve hour period and any storage in excess of the recommended reserve for fire will be available for domestic consumption. The recommended storage for fire is shown in Table B.

It is considered that the source must produce water for an eighteen hour period. This value, times the well yield, results in a value for the amount of water that can be put into service per day. Also included is the storage not required for fire reserve. The sum of those two values divided by the 1990 population, yields the water available in gallons per capita per day. If water demand exceeds this amount, meters or some other means of controlling water usage must be employed. The above approximate approach results in an adequate amount of water being available and is considered to be the general

analysis criteria which is applicable for all the communities studied.

Desired Yield of Source (gpm) $1.5 \text{ to } 2.0 \times \frac{\text{Average Daily Consumption}}{24 \text{ Hour/Day} \times 60 \text{ Minute/Hour}}$
 Desired Storage
 One Average Day's Supply

Summary of Analysis Criteria

Average Daily Water Consumption (gpcpd) 200
 Desired Output of System (gpcpd) 400

TABLE B

Desired Storage For Fire

Population	Storage (Gals.)	Population	Storage (Gals.)
200	26,800	2,200	92,800
400	33,400	2,400	99,400
600	40,000	2,600	106,000
800	46,600	2,800	112,600
1,000	53,200	3,000	119,200
1,200	59,800	3,500	135,800
1,400	66,400	4,000	152,400
1,600	73,000	4,500	169,000
1,800	79,600	5,000	185,600
2,000	86,200	5,500	202,200

Source: "Community Water Systems" by Ameen.

APPENDIX III.

COMMUNITY SEWER SYSTEM FACILITIES

ANALYSIS CRITERIA

The Montana State Department of Health has adopted the "Ten State Standards" as the criteria for the design of the various elements of the sewer system. Proposals contained herein are based on the recommendations of these standards.

Wastewater stabilization ponds are considered to be the most suitable means of sewage treatment for most smaller communities. The recommended sizes are derived from the criteria of one acre per one hundred population. This criteria is adequate if normal domestic sewage is encountered for all cases; however, more detailed study and analysis is required for final design.

Sewage collection and outfall mains are to be a minimum of eight inches in diameter according to the "Ten State Standards". This minimum is established since reasonably maintenance free systems will result. In many small communities, the sewage flow does not

justify this size; however, the possibility of plugging is minimized.

Capacities for the various size lines are determined for minimum grades with the pipe flowing two thirds full and are shown in Table C. Where sewage force mains are required, a minimum of four inch pipe is proposed. Larger lines are sized according to anticipated flow.

Criteria for the sewage flows used in this study are as follows:

Average sewage flow	100 gpcpd
Peak sewage flow (laterals)	400 gpcpd
Peak sewage flow (trunk and outfall)	250 gpcpd
Treatment facilities	100 gpcpd

The nominal determination of pond size is based on the following:

$$\frac{100 \text{ gpcpd} \times 180 \text{ day stor.} \times 7.5 \text{ gal/cu ft} = \text{one acre per}}{5\text{-ft water depth} \times 43,560 \text{ sq ft/acre}} \quad 100 \text{ people}$$

TABLE C
Average Capacity of Lines*

Pipe Diameter (inches)	Average Flow (gpm)	Population Equivalent (400 gpcpd flow)
6	110	390
8	200	720
10	320	1,150
		(250 gpcpd flow)
12	510	2,920
15	780	4,480
18	1,080	6,220
24	1,870	10,800

* Flowing two thirds full at minimum grade

